Design News

1961

Marking a new year gives mankind a reason to pause, look back and look ahead. The coming year holds challenging new demands for people everywhere. It will be the engineer's increasing responsibility to better use the world's energies and resources for the improvement of human welfare and progress.

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JANUARY 2, 1961

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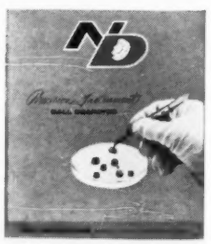
*Miniature and Instrument Ball Bearings.



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January 2, 1961
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DESIGN NEWS

News and Engineering Ideas. More than 48,000 copies every other Monday.

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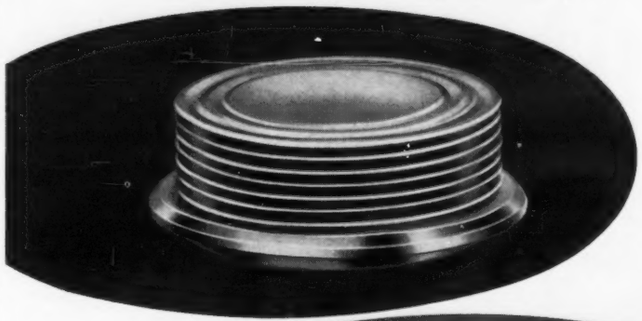
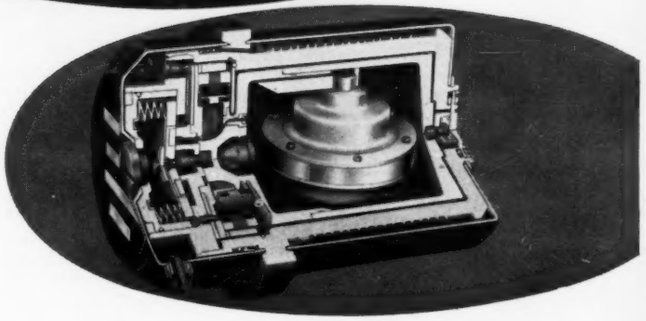
Published bi-weekly by Rogers Publishing Co. Editorial, Advertising and Subscription Offices: 3375 S. Bannock, Englewood, Colo. Telephone: SUnset 9-0571. Published at 85 W. Harrison St., Chicago 5, Ill. Accepted as Controlled Circulation Publication at Chicago, Illinois. Send form 3579 to subscription offices.

WELDED DIAPHRAGM BELLOWS
Engineered By

METAL Bellows

Selected by Minneapolis-Honeywell For New Gas-Bearing Gyroscope





The complex new gas-bearing gyroscope shown here in a cut-away has a bell-shaped ceramic spin motor. Its interior spins at 24,000 revolutions per minute suspended on a film of helium gas only 25 millionths of an inch thick. The gyro weighs just 8 ounces, is 2.8" long and 2.0" in diameter.

Here is what the Welded Bellows Assembly Selected provides in this Minneapolis-Honeywell gyroscope:

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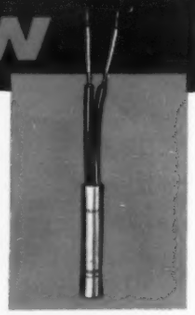

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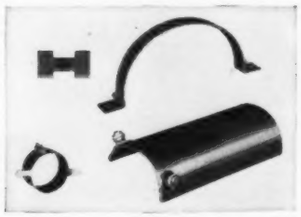

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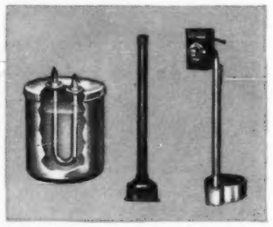

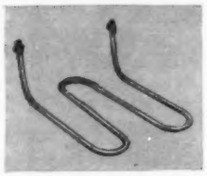

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SOUNDING BOARD

FOR OUR READERS

No One's Pride Is Worth a Single Life

I have just finished reading your editorial in DESIGN NEWS (Nov. 7, 1960) about "Auto Safety—a Record?"

I wish to congratulate you about this timely and courageous exposure of a major industry's indifference and callousness toward the lives of human beings. It is time that the public is informed on this, because unless the public takes a stand on safety and demands it, industry will never respond.

In 1956 at the SAE annual meeting, I called attention to a very dangerous element of control in certain cars and pointed out how many accidents were caused by it, including many lives lost. I was told by the speaker that there were more than five million cars with it now on the roads, and it would not be practical to change it as it would create more confusion.

The next year two or more makers changed them, but four or six makers are still continuing. So in a meeting in 1957 I congratulated the ones that made the change, and I asked the others to please follow because no one's pride was worth a single life of a fellow being. I was criticized for this statement as being too harsh. I suppose the people who died because of it were killed very gently.

My 32 years of experience with this industry have convinced me, and the statements of many of its leaders that "the only improvement in cars to be acceptable has to be, first, apparent outwardly, second, readily noticeable to the public in riding or handling the car and third, costs no more than the early models" are proof that your voice is already lost in the wilderness.

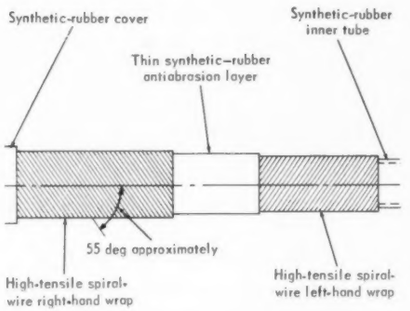
I always admire courage—I am sure you have it. Congratulations again and with best wishes and regards.

OSCAR H. BANKER
President
New Products Corp.

Mathematical Solution?

Under hydraulic pressure, angle of wire reinforcement will equalize to approximate angle as shown. Can any of your readers supply mathematical solution?

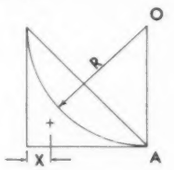
E. D. JONES
Chief Engineer
Republic Rubber Div.
Lee Rubber & Tire Corp.



WIRE-REINFORCED HIGH PRESSURE HYDRAULIC HOSE

Center of Gravity of Fillets

With reference to your Sounding Board letter of Mr. Raymond Moore (Aug. 29, 1960, DESIGN NEWS), there appears to be a slight error in the coordinates x and y of the center of gravity of fillets in the last two decimal places. The derivation is quite simple:



moments about OA

$$(R\text{-}X)\ 0.2146\ R^2 = \frac{R^2}{2} - \frac{2R}{3} - \frac{R^3}{6} = \frac{R^3}{6}$$

$$\text{i.e., } R - X = \frac{R}{6 \times 0.2146}$$

$$X = R(1-0.7766) = 0.2234R$$

J. L. H. BISHOP
Technical Data Engineer
The Austin Motor Co., Ltd.

Needed to Be Said

I was delighted to find the editorial in the Nov. 7 issue on "Auto Safety—a Record?" I want to congratulate you on the boldness of your approach for saving the things that have needed to be said for so long a time.

I have taken the liberty of paraphrasing some of your material in the enclosed letter to the editor of "Time" in the hope that such material can be brought to an even greater segment of the public.

I hope that your advertising support is broad-minded enough to allow you to continue this fearless policy.

ERNEST RATTERMAN
Cincinnati, Ohio

1961

By the time this issue of DESIGN NEWS reaches its readers, the year 1960 will have passed into the history books. Rather than trying to peer into the future, I feel this is a good time to review briefly some of the important events of 1960.

From the standpoint of engineering, the year 1960 saw some spectacular progress in the field of space and guidance systems. Headlines screamed such improbable feats as "Discoverer Capsule Snagged in Mid-Air over Pacific" and "Russians Send up Space Ship".

Overshadowed by the more spectacular events, but nonetheless important, was the progress made in the general field of automation and machine controls. It was evident at the machine tool show in Chicago that the greatest effort of the tool manufacturers during the past year has gone into the field of automatic control. This is as it should be, because only a greater degree of automation will enable us to produce more goods per man hour. Our survival depends on our being able to produce goods at a price which will be competitive in the world markets.

A few changes were made in DESIGN NEWS during the year 1960 in recognition of the greater importance of special branches of engineering. Design idea articles, once simply grouped together, are now grouped into the "mechanical", "electrical", "materials" and "control systems" sections. This change was made in April and is intended to make it easier for readers to spot ideas in their particular fields. It has become very evident, particularly during the last year, that mechanical engineers are being forced to take on an additional degree of specialization and therefore need ideas along these more specific lines. Since April, DESIGN NEWS carried 161 mechanical design ideas, 58 electrical design ideas, 38 design ideas based on materials and 17 control systems ideas.

It is our intention to continue to publish design ideas in graphic form for engineers who find very little time to read complicated articles of the "how to" variety. We also will continue to publish useful reference articles in the Design Data section. Here, too, the emphasis will be on material that will speed up the job of the designer—not long dissertations on methods of design. We will also continue to announce useful new products and new literature available to engineers.

The entire staff of DESIGN NEWS joins me in pledging our continuing support to the engineering profession during 1961.

Managing Editor

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DESIGN ENGINEERING NEWS

Vehicle Exerciser Permits Programmed, Simulated Road Testing

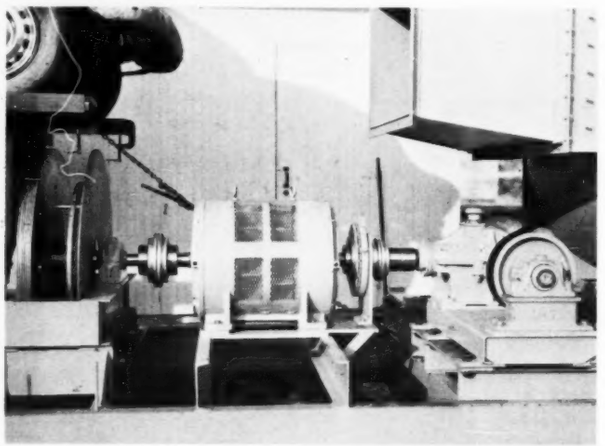
Robert L. Candlish, Detroit Editor

MOORESVILLE, IND.—Vehicle exerciser automatically conducts repetitive vehicle road tests by simulation in a laboratory. This eliminates effects that weather and test variables have on normal road testing and permits differentiation between test results when small changes occur. Units have been designed for 0- to 100-mph testing and permit safe operation of 2000- to 6500-lb cars at these speeds. Sufficient braking force is available to stop cars from 85 mph in less than 20 sec. Brakes also can be energized to simulate grade climbing.

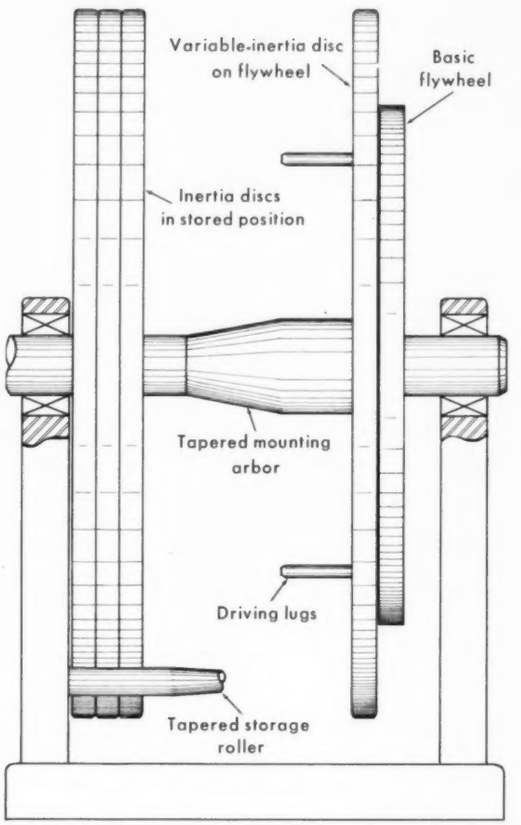
The use of an electric dynamometer to supplement fan power loading permits application of automatic controls to this system. A magnetic tape playback controller works through a closed loop servo system and can be made to control actual engine variables and a reproduction of the engine's response to the original driver of the vehicle.

Control tapes can be actual or synthesized to set any function versus speed at any tape position (time). The braking or motoring system will load or motor the vehicle in a combination manner so that, as the controlling function (such as manifold pressure) is varied, the loading on the vehicle is varied also.

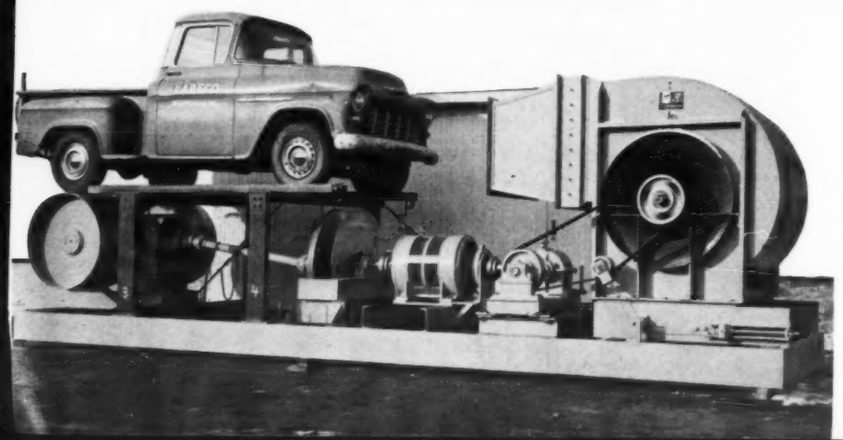
Basic design of the automatic vehicle exerciser was developed by scientists of the Socony Mobile Oil Co., Inc., Paulsboro Research Laboratory. This installation was designed and built by the Laboratory Equipment Corp.



DISCS for increasing inertia of flywheel are shown in stored position. "Dynamatic" brake through right of dynamometer is "hold roll" device and is energized automatically at zero-mph condition to simplify vehicle positioning.



EXTRA DISCS for variable inertia flywheel are mounted on tapered storage rollers and are supported by fastening to flywheel bearing supports. In mounting, discs are moved off taper rollers and onto tapered flywheel arbor and are bolted to flywheel.



VEHICLE EXERCISER incorporates air blowing loading device, variable-speed motoring unit, positive locking brake, mechanical inertia system, 100-hp eddy-current brake and interconnected rolls, all mounted on integral base ready for installation. The unit is approximately 28 ft long, 8 ft wide and ramp levels 5 ft above bottom of base. Speed-increasing gear box is mounted at chassis rolls to match low rotating speed of rolls to torque absorbing characteristics of dynamometer. Gear reduction is used after dynamometer to obtain proper fan rotor speed. Variable-speed power unit for motoring vehicle also works through this gear reducer.

Transverse Propeller Improves Low-Speed Maneuverability of Ship

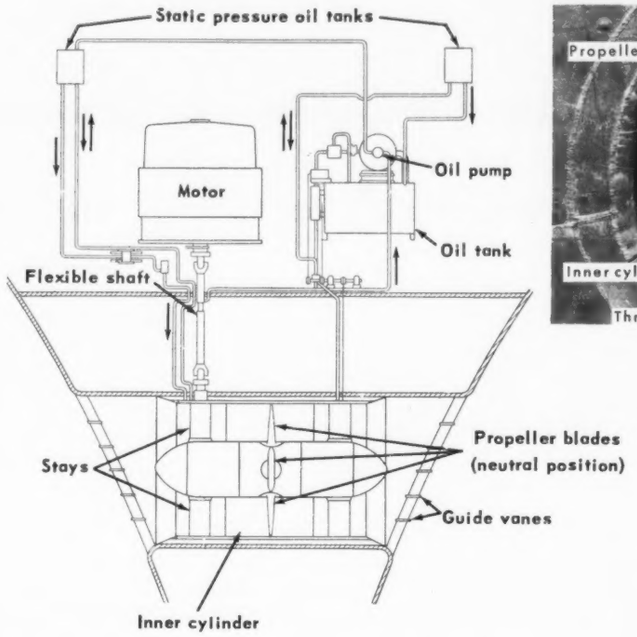
Volrath Holmboe, Correspondent in Sweden

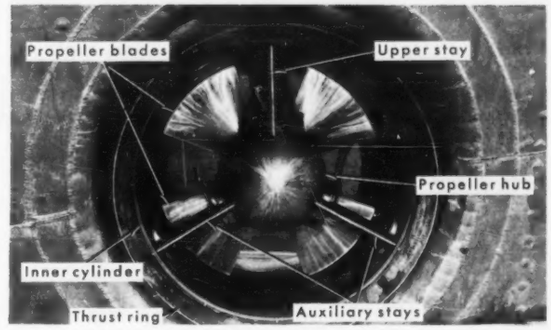
KARLSTAD, SWEDEN—A ducted, variable-pitch propeller near a ship's bow is used instead of conventional rudder to obtain good low-speed maneuverability. Together with two side-by-side main propellers in the rear, it permits the ship to move and turn in any direction.

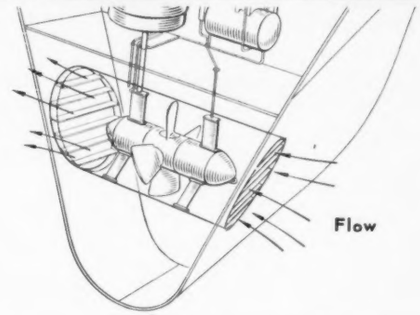
The four-blade propeller is in a transverse cylinder, with a streamlined propeller hub held by three stays at each end. One of the stays accommodates the transmission from the motor via SKF bevel gears and roller bearings to the propeller shaft. A stay in the other end of the hub contains hydraulic lines for the variable-pitch mechanism. Propeller shaft sealing is obtained from two static pressure oil tanks located well above the water line, providing a high constant pressure in the bearings. This, together with a series of lip-type, grease-filled seals, prevents water from entering into the hub.

A flexible shaft between motor and propeller absorbs torsional vibrations and axial displacement. A universal joint in each end also permits some misalignment.

The steering propeller, designed by AB Karlstads Mekaniska Werkstad, is located in the Danish railway ferry, "Prinsesse Benedikte". The flexible shaft was delivered by Vulkan Kupplungsund Getriebebau, Germany.



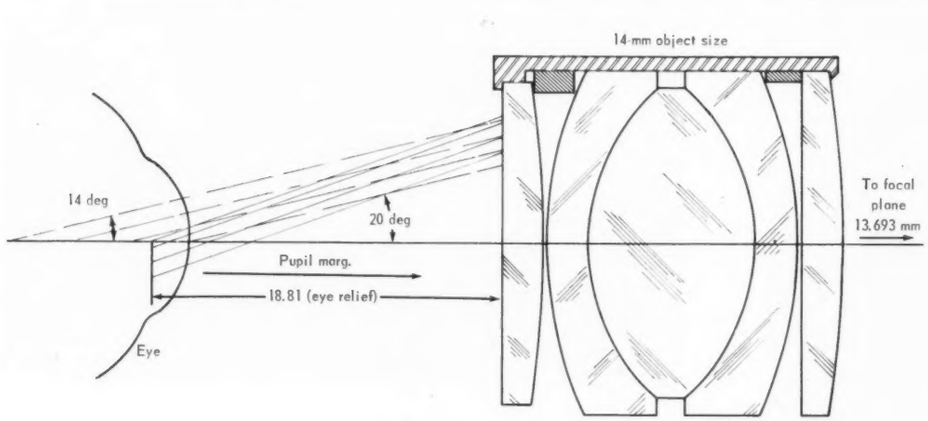




INNER CYLINDER with propeller and stays forms removable unit. It is kept in position by thrust rings in each end. Ducted fan effect cuts tip losses and provides high propeller efficiency. Steering propeller is driven by 300-hp electric motor. This is about three percent of ship total power. Interlock prevents motor from being started when propeller is not in neutral position. Arrangement avoids excessive starting moments and eliminates unintentional side thrust when motor is started up.

Magnifier Provides Improved Optical Performance

Lars G. Soderholm, Midwest Editor



SKOKIE, ILL.—A new type of magnifier using five optical elements provides 13-power magnification with a 14-mm field and has an 18.8-mm eye relief. The large field at high magnification and long eye relief represent an improvement over existing types of magnifiers.

The magnifier uses a center element of low-index crown glass flanked by high-index flint glass elements on either side to establish strong negative surfaces. The outermost elements are also of crown glass.

Design was by John R. Miles Co. for the Council on Library Resources, Inc., Washington, D. C. The development makes more convenient use of microreproductions on cards as found in many library files.

Rhomboidal Wheel Arrangement Improves Load Distribution

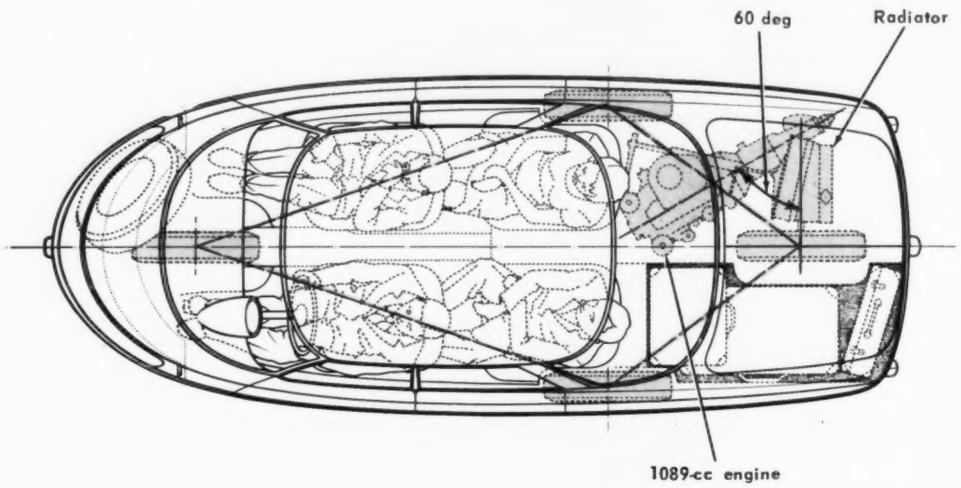
Celestino O. Lubatti, Italian Editor

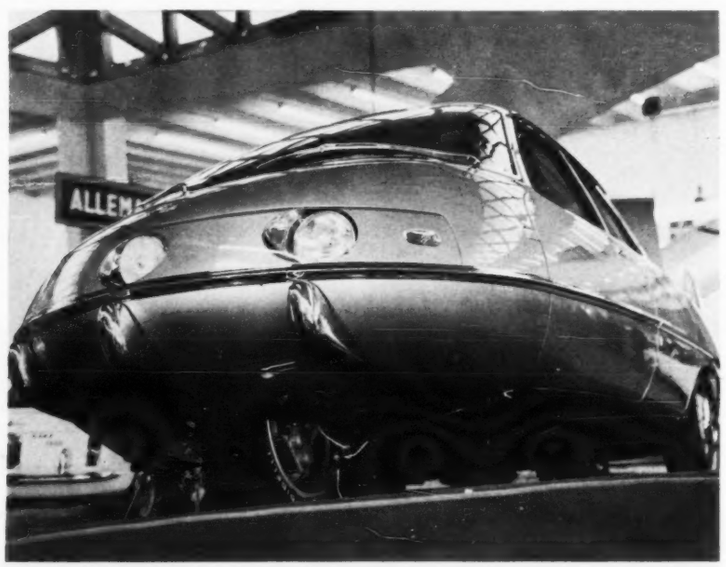
TURIN, ITALY—A rhomboidal wheel arrangement with only two side wheels reduces torsional body stresses originated by uneven ground. Simple bending stresses in body sections allow reduction of weight and production costs.

Elimination of differential gear and propeller shaft reduces weight and complexity of the drive mechanism. A worm gear connects the FIAT 1100, 43-hp engine with the wheel axle. The engine is inclined to reduce space and load on side wheels. A cooling fan draws air through the radiator located in the engine compartment.

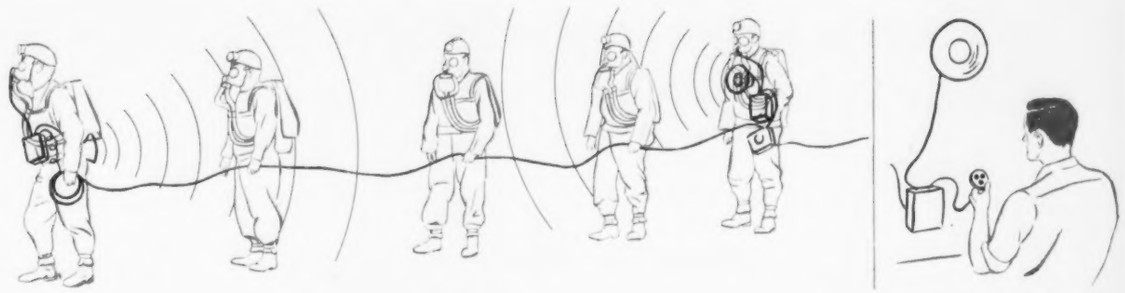
Static load is 160 kg (13 percent of total weight) for each side wheel, 450 kg (37 percent of total weight) on steering and drive wheels. A single steering wheel requires lower speed for curves with less than 30 meters (98 ft) radius but minimizes steering effort and simplifies the steering gear.

Drag coefficient of this experimental vehicle, manufactured by Carrozzeria Pinin Farina SpA, is about 0.2 compared to 0.4 for a common four-seater. Design is by Ing. Alberto Morelli.





RHOMBOIDAL WHEEL ARRANGEMENT permits low body-structure, improves streamlining and load distribution. Luggage space is formed in back and front compartments.



Potting Compound Doubles as Case for Rescue Phone Amplifier

E. J. Stefanides, Central States Editor

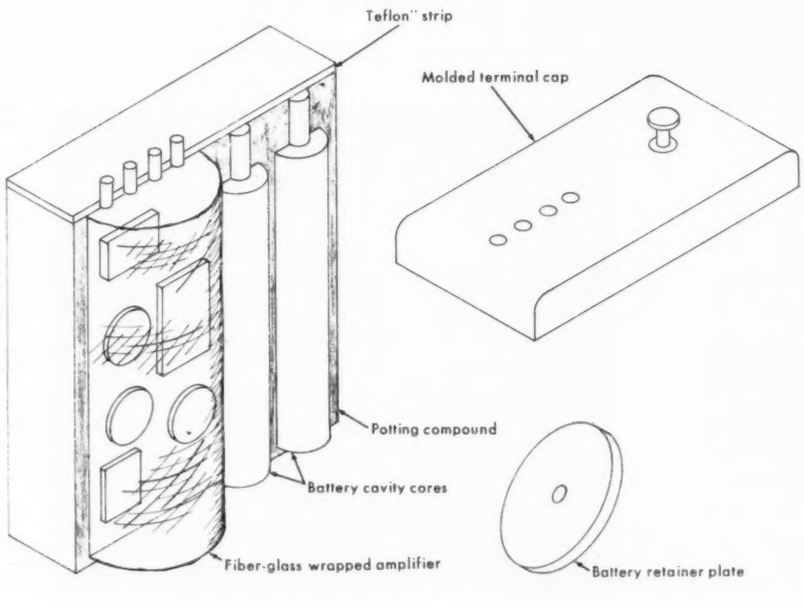
PITTSBURGH, PA.—The case of a new mine rescue phone amplifier is formed by the fiberglass-reinforced polyester-resin block in which the transistor amplifier is potted. This method of encasing protects the amplifier printed circuit and components against damage from impact and rough handling and moisture. It also provides maximum protection against sparking in the explosive fire-damp (methane air) atmosphere in which the rescue team operates.

The amplifier is part of a new mine rescue communication system that is the first portable telephone rescue equipment to be approved by the United States Bureau of Mines for operation in explosive atmospheres. Three of these amplifiers are used in the system and each or all of them can simultaneously power the three loudspeakers used to provide inter-team and team-to-base communication.

Potting procedure is simple. The leads of the printed circuit amplifier are brought through a "Teflon" top strip and secured. The amplifier is then wrapped in a single thickness of fiberglass cloth. Battery cavity cores are set into the bottom of the mold. The amplifier is aligned in the mold and the polyester-resin liquid poured. After several hours of curing the mold is opened, the "Teflon" strip removed and the block fitted with connector block and the battery retainer plate.

The system was designed by the Mine Safety Appliances Co.

MINE-RESCUE COMMUNICATION SYSTEM consists of three ceramic microphones, three loudspeakers and three transistor amplifiers. Talking line is on special reel which allows continuous communication while unwinding.



TRANSISTOR AMPLIFIER powers all three loudspeakers. Entire amplifier is potted in reinforced polyester-resin block which also serves as case. Mercury batteries are removable; they provide 12v, 200-hour life.

Vic Wigotsky

(B.S.—M.E., University of Colorado)

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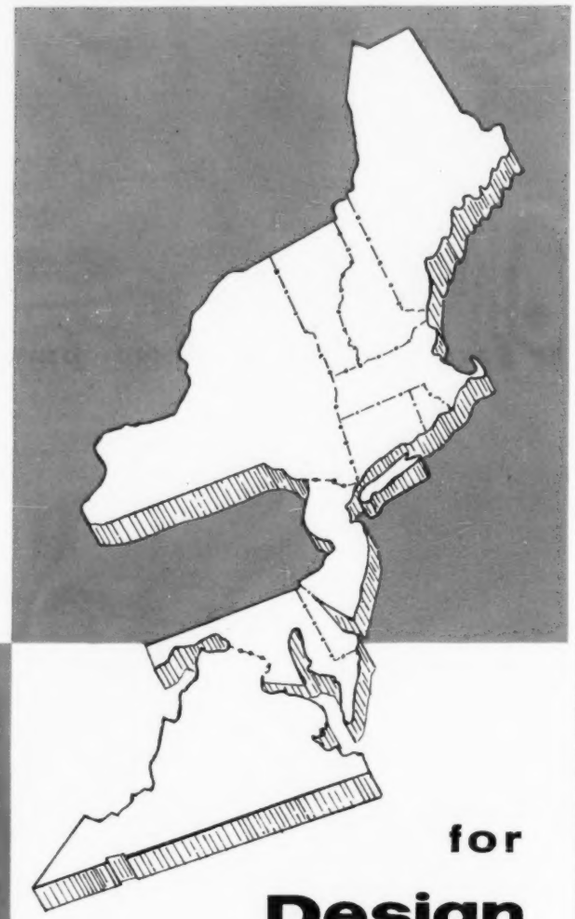

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SEEN AND HEARD

Touché, Cliché

Victor W. Wigotsky, Eastern Editor

Happy New Year—and I hope it will be an improvement over last year in at least one way. I hope that engineers and designers will not be badgered with the term "designing for obsolescence".

The phrases "designing for obsolescence" and "product death rates" have been hammering away at our ears incessantly these days. Some who discuss the subject are sincere and searching. Others are mere opportunists, latching onto catch-phrases and crying "plague", but offering no solutions at all. And in the middle of all this are the engineers and designers.

It was, therefore, with much interest that I attended a panel discussion moderated by Alfred Auerbach and sponsored by the Industrial Designers Institute on the subject, "Is Obsolescence Obsolete?" The meeting dealt with Vance Packard's book, "The Waste Makers". Mr. Packard, who had been invited to defend his charges, did not appear. There was general agreement that it is time to lower the boom on an irresponsible exercise in semantics.

Columnist Earl Lifshey of "Home Furnishings Daily", taking strong issue with "The Waste Makers", stated that, "Without planned obsolescence this country could never have achieved the great economic growth it has. I agree that there is evidence of misdirection and waste in the manufacturing and marketing segment of our vast economic complex. But who," continued Mr. Lifshey, "is the genius qualified to say where, when and how in our economy the line should be drawn between what is properly obsolete and what is not—what the manufacturers should design and produce and what they should not—or what the people in this country ought to want to buy and what they should do without, in order to maintain the ultimate in efficiency and abolition of waste."

Designer Carl Otto maintained that there is no such thing as a "built-in death rate", but that obsolescence really occurs through growth and as an inevitable result of competition.

J. M. Toney, Vice President in charge of special products at RCA agreed, and upheld the reign of the customer. "He is still king," insisted Mr. Toney, "and keen competition sets the pace of design to prevent conscious making of 'inferior' products."

E. E. Anderson, American Motors Director of Automotive Styling, discussed his company's somewhat novel concept—for the industry—of stability

in design to foster customer confidence.

The general discussion centered on the conflict between the creative designer and the creative marketer, the public's right for self-indulgence, its quest for newness and the responsibility of management.

Staff designers and engineers deserve better treatment than the term "obsolescence" implies. They are basically creative individuals who must work by certain rules and perform according to policies set before them. The implications in the terms "designing for obsolescence" or "setting product death rates" stigmatize them unfairly when analyzed in the light of economic reality and their working boundaries. Such fields as economics, sociology, psychology are also intimately involved.

And who can deny that "planned obsolescence" is actually "planned economics"—functioning in a free enterprise system? Anyone who has seen a dormant automobile production line can easily translate this to unemployment and much more than the absence of "short-life products". Surely trumpeters of our so-called shortcomings must take pause at this spectre.

"Designing for obsolescence" is a neat little misleading phrase seemingly fraught with "bogey men". However, the phrase is essentially a play on words that really beclouds the fundamental issue. The issue is not that of "designing for obsolescence" or setting "product death rates", but designing to produce a salable product. Under a system of free enterprise we all have a stake in profits. Equate obsolescence with profit, if you wish to play at semantics. If a designer chooses a lighter gage steel or a less expensive plastic or a shorter-life component than is available, don't blame him. This is dictated by the cost complex and competition.

Rather than talking about "designing for obsolescence", isn't it more accurate to speak of "designing for sales", "designing competitively" and "designing to keep people employed in America"? If this means compromise in designing, the designer does not choose to compromise but must compromise to stay professionally alive.

It seems that the negativism implicit in the term "designing for obsolescence" is really just the hole in the doughnut. Dynamic design, however, is an essential ingredient of the doughnut itself.

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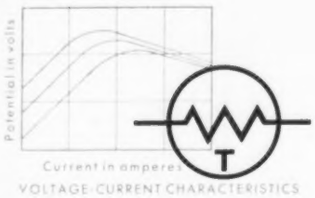

Thermistors

And Their Applications

P. R. Taylor, Assistant Editor

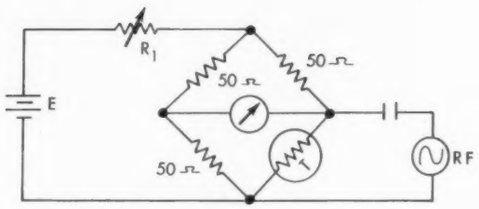

Fig. 1

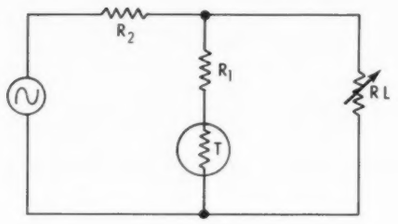

Fig. 2

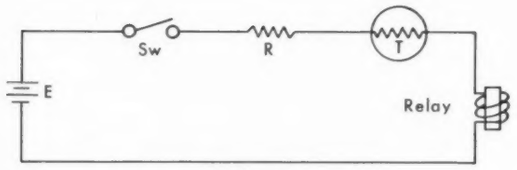

Fig. 3

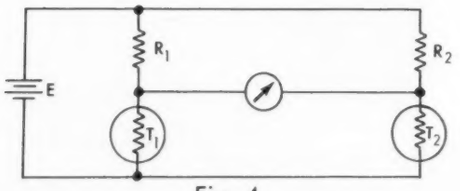

Fig. 4

Thermistors (thermal resistors) have a high negative temperature coefficient of resistance. Their resistance is a function of absolute temperature. As temperature increases, resistance goes down and as temperature decreases, resistance goes up.

Thermistors are semiconductors of ceramic materials made by sintering mixtures of metallic oxide such as manganese, nickel, cobalt, copper, iron and uranium. They are available in a variety of types, a broad range of electrical characteristics and in the form of discs, washers, rods, beads and plates. Resistances may range from a fraction of an ohm to 100 megohms.

Good stability is an important feature of thermistors. Tests indicate that most aging occurs during the first day or week. After this initial period, their age rate per year is only about 0.2 percent. The expression which relates resistance to absolute temperature is:

$$R = R_o \, EXP\left[\beta \frac{1}{T} - \frac{1}{T_o}\right]$$

where R_o = resistance at absolute temperature T_o
R = resistance at absolute temperature T
β = constant which depends upon material used to make the thermistor.

Thermal Time Constant

"Thermal time constant" is the time required for a thermistor to reach 63 percent of its final steady state temperature, when heated from an external source. For example, if a tnermistor at zero C is placed in a 100C oven, the time required for the thermistor to reach 63C is its time constant.

Dissipation Constant

"Dissipation constant" is the amount of power required to raise the temperature of the thermistor 1C above ambient (usually measured with the thermistor suspended by its lead in still air at 25C). The unit is mw/deg C. The dissipation constant, which is a measurement of heat transfer between the thermistor and its surroundings, is a function of:

1. Method of mounting
2. Nature of the medium—liquids, solids or gases
3. Motion of the medium.

Each of these factors also affects the thermal time constant. For any given thermistor, an increase in the dissipation constant will decrease the time constant.

Thermistor Voltage-Current Characteristics

If a very small voltage is applied to a thermistor, a small current will flow which will not heat the thermistor measurably above ambient. Under these conditions, Ohm's law will be followed and the current will be proportional to the applied voltage. A voltage-current curve shows that, as the current increases, the voltage drop increases to a peak value beyond which the voltage drop decreases as the current increases. In this portion of the curve, the thermistor is exhibiting a negative resistance characteristic. This is due to the temperature increase in the thermistor produced by the power being dissipated, which lowers the resistance.

Applications

Applications can be divided into three broad classifications, depending upon the method in which they are used:

1. A resistance change produced by a change in power dissipation in the thermistor.
2. A resistance change due to a change in the dissipation constant.
3. Resistance control by control of external temperatures.

The first group, which uses self-heating, includes power measurements. A thermistor is used as a bolometer (an instrument for measuring radiant energy) in a balanced bridge (Fig. 1). If a 1K thermistor is placed in a 50-ohm bridge circuit, the variable resistor in series with the bridge may be adjusted so the thermistor will heat enough to lower its resistance to 50 ohms and the bridge will balance when

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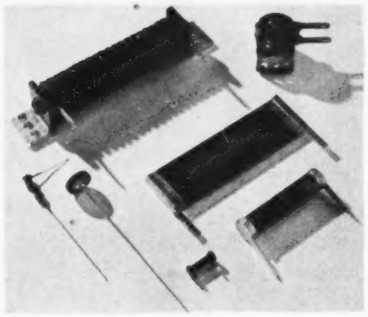
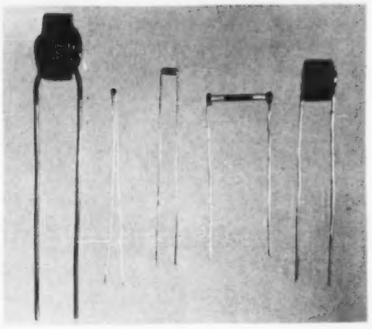


THERMISTORS offer wide range of temperature coefficient characteristics. Coefficients available are approximately 0.3 percent per deg C to 5.1 percent per deg C at 25C. Thermistors are bonded ceramically through high-temperature firing process into disc and rod-shaped bodies.

Carborundum Co., Refractories Div., Perth Amboy, N. J.

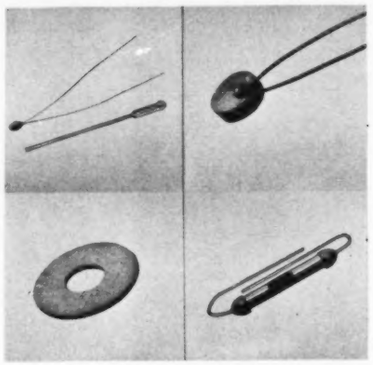


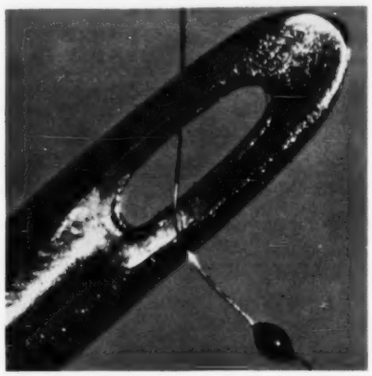
BEAD AND ROD THERMISTORS offer close electrical tolerances. Small mass of 0.1-inch dia bead units give short thermal time constant, yet are not so small that they are difficult to handle. Various "special" thermistors are available developed for particular applications.

General Electric Co., Magnetic Materials Section, Edmore, Mich.

THERMAL RESISTORS, left to right, include beads and glass probes, discs, washers and rods. Beads are sealed into tips of solid glass rods of up to 0.100 inch maximum diameter and ¼ to 2-inch lengths. Normal discs are from 0.1 to 1-inch dia and 0.020 to 0.5-inch thickness. Washers are made in same manner as discs, except hole is formed in center so unit can be mounted on bolt. Rods are normally 0.053, 0.112 or 0.173 inch in diameter and from ¼ to 2 inches long.

Fenwal Electronics, Inc., Framingham, Mass.





TINY BEAD THERMISTOR (200X) finds use in detecting R-F currents in wire or film of electro-explosive devices of guided missiles and rockets. Device is so small that several units can be packaged in micro-miniature space.

Victory Engineering Corp., Union, N. J.

no RF power is present. D-C power can be calculated. If RF power is applied, it will be heated still further and the bridge will be unbalanced. The d-c power in the thermistor may be reduced until the bridge balances again and the new d-c power calculated. The difference between the two d-c powers calculated will be the RF power. This type of bridge offers a constant impedance load on the RF source.

Voltage Regulators

Thermistors may be used as voltage regulators when they are operated in the negative resistance portion of the voltage current curve (Fig. 2). If resistor R1 has the same value as the negative slope of the V-I curve, the net result of the two elements will be a V-I curve of approximately zero slope over a broad range of current. This means the voltage E_o will be a constant over this current range, which may be as great as 60:1.

Time Delay Circuits

Time delay devices can be constructed with thermistors, using their self-heating characteristics (Fig. 3). When the switch is closed, a small current will flow in the circuit which will dissipate a small amount of heat in the thermistor. This will decrease the resistance and increase the current flow. Self-heating continues until thermistor resistance is reduced enough to allow the value of current to flow that will operate the relay. The time required for the current to increase to its final value is a function of the circuit resistance, applied voltage and thermistor dissipation constant. (This should not be confused with the "thermal time constant".) The delay time, therefore, may be controlled by Resistor R.

Applications of thermistors which depend on changes in the dissipation constant include vacuum gages, flow meters and gas analyzers (Fig. 4). In this circuit two thermistors are mounted in a bridge and enough current flows through them to increase their temperature about 150C above ambient. Each of the thermistors can be placed in small cavities that contain air, as a bridge balance. If the amount of CO_2 present in one cavity increases, the bridge will be unbalanced; since the CO_2 has a lower thermal conductivity than air, the temperature of the thermistor will increase. The output can be calibrated in terms of percent of CO_2.

Flow Meter

Another use of this bridge is as a flow meter. One thermistor is shielded from the flow and a shield is placed in the flow path. When a fluid flows past one thermistor it is cooled and its resistance increases. The amount of cooling is proportional to the rate of flow and output may be calibrated in these terms. Such instruments have been developed to measure flow rates as low as 0.001 cc per minute.

Vacuum Gage

A vacuum gage is another application of the bridge. If one thermistor is mounted in the vacuum chamber, its dissipation constant will be proportional to the density of air that surrounds it. Its temperature and therefore its resistance will be proportional to the pressure in the vacuum.

For temperature measurements, thermistors may be used in the cirucit of a blocking oscillator. Resistance of the thermistor controls the pulse rate of the oscillator, which may drive a radio transmitter. Therefore, the pulse rate is a measurement of thermistor termperature. Thermistors may be used in temperature control circuits and temperature warning devices. The thermistor needs no reference temperature in order to measure absolute temperature, and it does not require sensitive measuring instruments on the output of the bridges to detect small temperature changes. These are two advantages that the thermistor has over thermocouples.

Conclusion

There are numerous applications of thermistors. The future design possibilities are limited only by the ingenuity of the design engineer. Thermistors are available from manufacturers in the specific size, shape or form to fit almost any application.

Information presented in this article was provided by Donald E. Rugg, Research Eng., MSEE, Electronics Div., Denver Research Institute, University of Denver, Denver, Colo.

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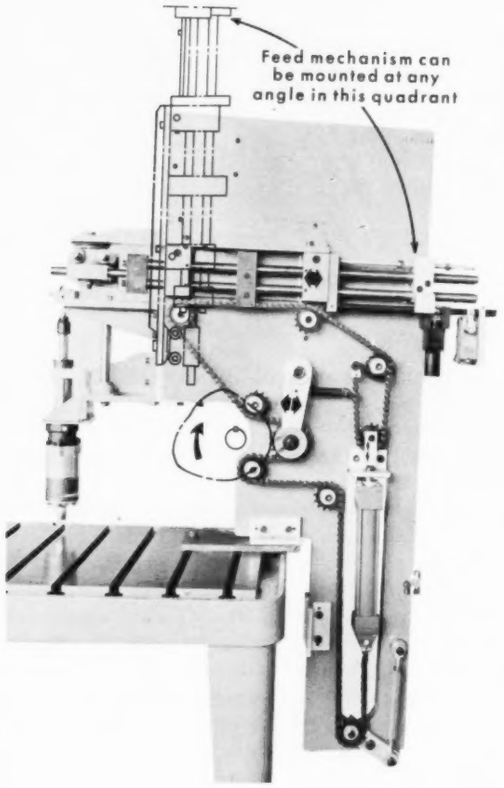
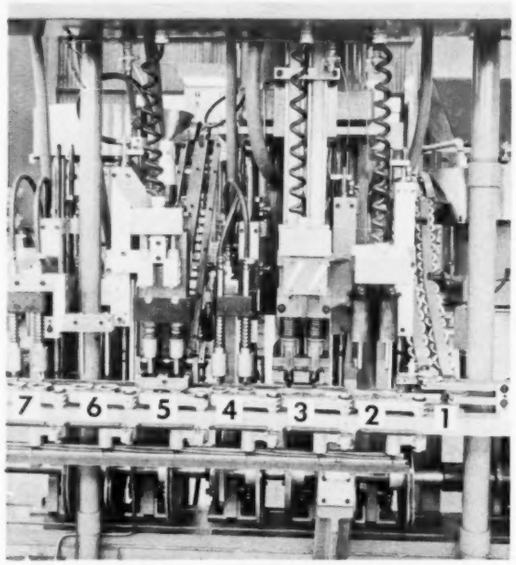
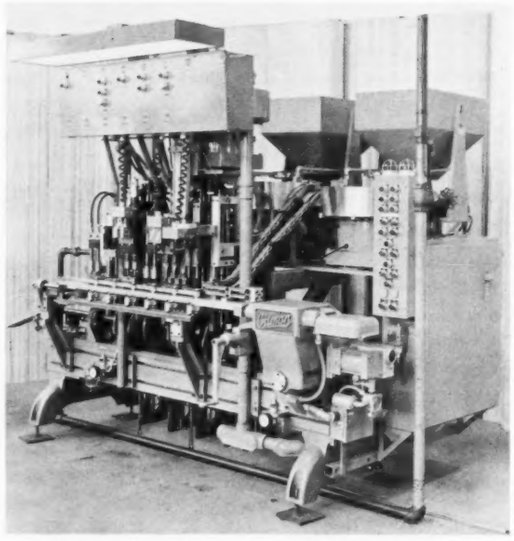
Air Cylinder Controls Tension Movement on Assembly-Machine Feed Mechanism

Lars G. Soderholm, Midwest Editor



BASIC FEED MECHANISM receives motion from split cam mounted on common cam shaft. Cam follower and follower sprocket are interconnected to take up roller chain. One end of chain is connected to slide and to piston of air cylinder. Opposite end is connected to shell of air cylinder. As follower arm is moved by cam, roller chain is taken up between two idler sprockets. Pulley arrangement gives mechanical advantage so pull on chain is compensated by extension of air cylinder piston. Controlled chain movements permit guide bar travel in both directions up to seven-inch maximum stroke.





An air cylinder is used to maintain roller chain tension in the feed mechanism of an assembly machine that assembles automotive window regulator clutches. The air cylinder also provides overload protections for both forward and backward movements. A floating feed tube is used to hold the lightweight, easily deformed plastic spacer rings so they may be fed into the loading mechanism.

The automatic assembly machine inserts a plastic spacer ring and a tension spring inside a regulator clutch case. The regulator clutch permits an automobile window to be raised and lowered with the window crank but does not allow a force on the window to be transmitted back.

There are 8 stations in the assembly machine. At stations 1 and 2, stamped clutch cases are hoppered onto the hardened transfer ways and checked for presence and position. Station 3 inserts plastic spacer rings into the cases and checks them in a combined operation. At station 4, grease is applied to the inside of the case. At the next station, the torsion clutch springs are inserted by an air motor to give a controlled twisting movement. Twisting is necessary because the springs have a normal OD larger than the ID of the case. Station 6 is open. Station 7 greases the inside of the spring. The last station transfers the complete assembled unit to an unloading chute where the units that did not pass the checking stations are rejected.

Station 2 determines if a case is present; if not, the machine does no further work on the set and rejects them at the last station. Station 3 inserts spacer rings and, on down-movements, checks to determine if they are in place. Station 5 inserts the torsion springs and checks them. The machine is built with a memory that enables it to reject a part if any of the three inspection stations indicate faulty assembly.

This transfer machine was designed to produce parts at a gross rate of 3600 parts per hour. This represents a 2-sec cycle with two assemblies produced per cycle. The "Transferline" assembly machine is made by the Gilman Engineering & Mfg. Corp., a subsidiary of the Parker Pen Co., both of Janesville, Wis., for a leading automotive manufacturer.

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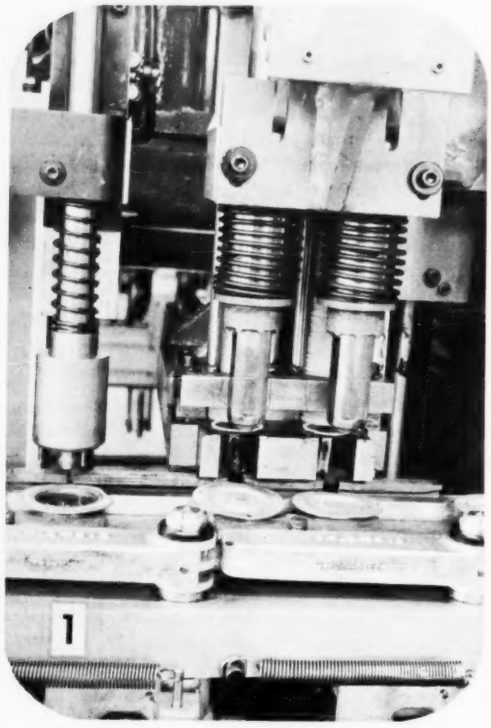
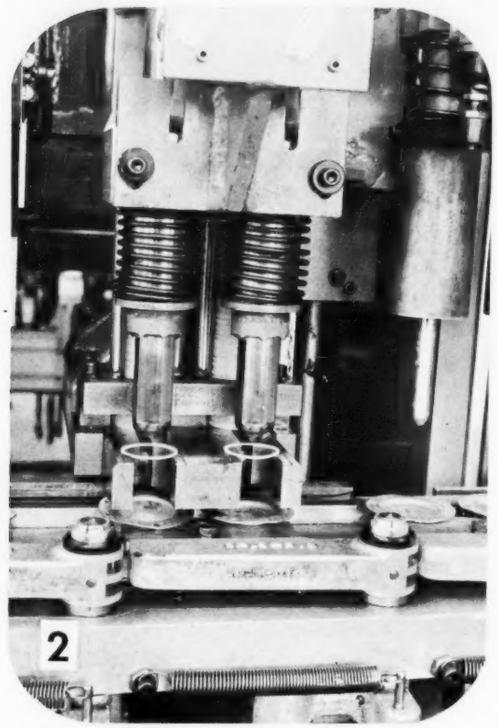
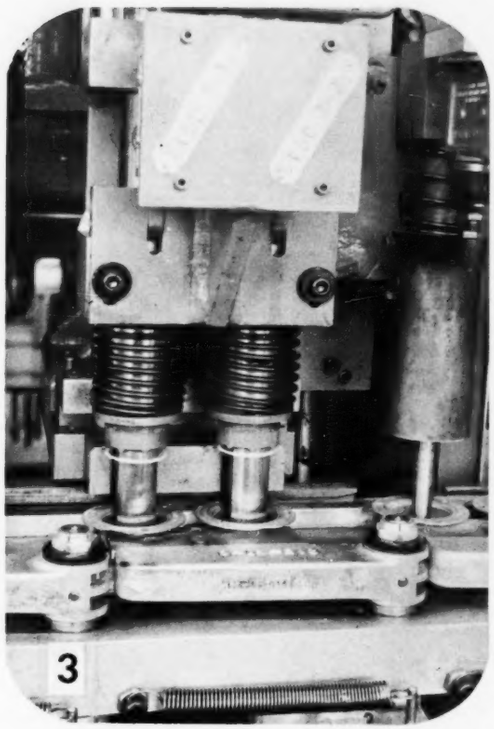
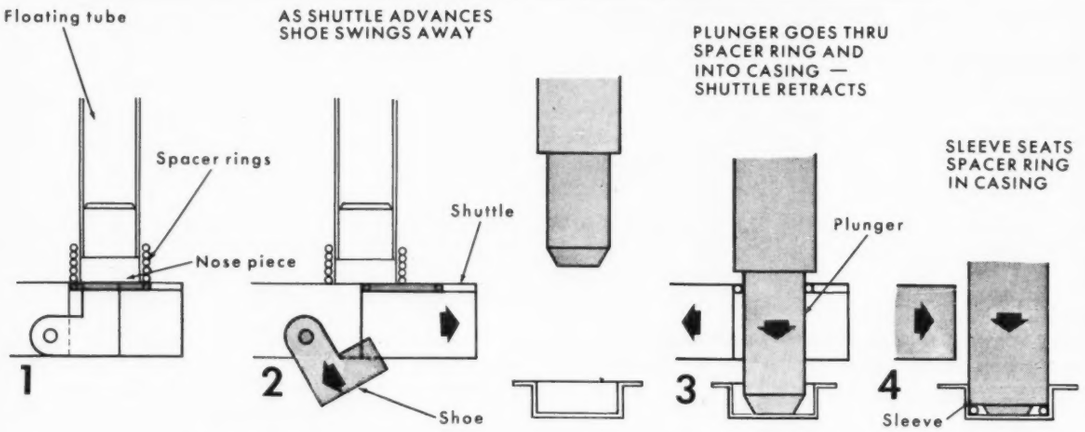
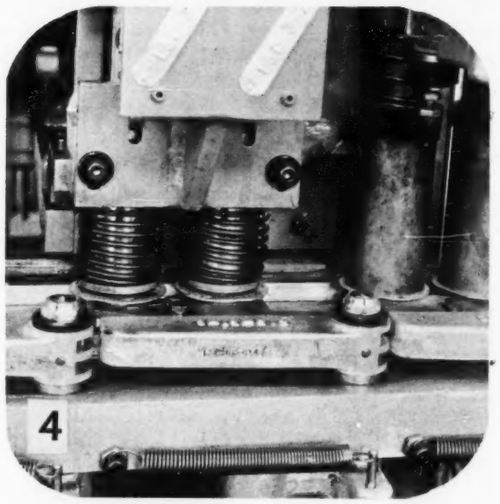






HORIZONTALLY POSITIONED FEED MECHANISM CONTROLS SHUTTLE MOVEMENT
VERTICALLY POSITIONED FEED MECHANISM CONTROLS PLUNGER MOVEMENT





FLOATING FEED TUBE holds stack of small molded-polyethylene spacer rings waiting to be inserted into clutch casing. Rings are held on floating metal tube having 1/16-inch smaller diameter than ID of rings. Plastic nose piece rests on metal shoe. Milled pocket in shuttle accepts only one plastic ring as it moves under floating tube. When shuttle advances enough to hold tube, hinged shoe drops and shuttle advances, placing ring under plunger and sleeve for insertion into casing. Plunger passes through center of ring and into clutch casing. Shuttle is retracted, leaving ring on plunger. Plunger sleeve moves down to press ring into casing. Distance plunger sleeve moves is read through bellcrank linkage by miniature switch which actuates memory device. Too much movement of bellcrank link indicates no ring is present and a signal for rejection is sent to last station.

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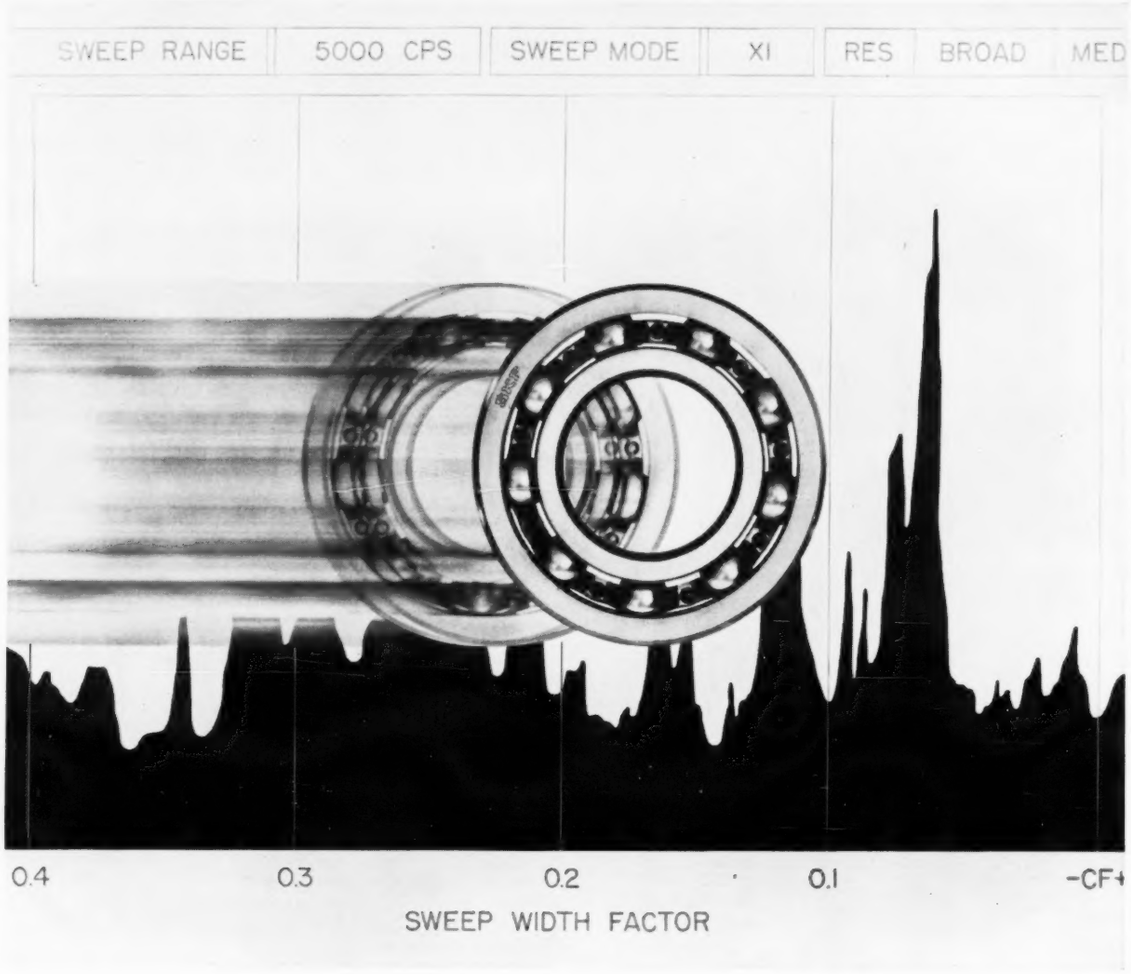

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Optical System, Feed Rate

Lars G. Soderholm, Midwest Editor

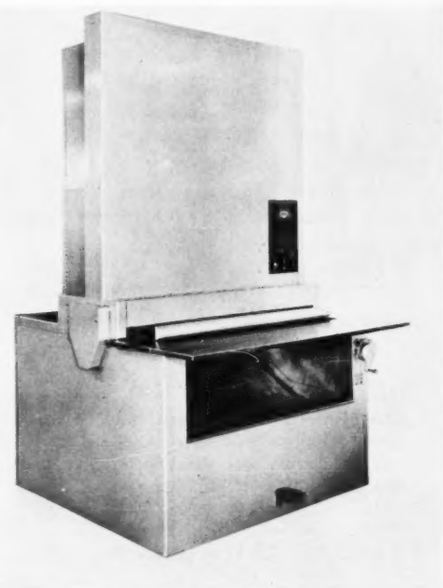
A continuous printer uses a system of lens, mirrors and coordinated feed rates of the sensitized paper to optically reduce an original tracing. This unit prints a smaller-sized transparency in a single direct operation. The width of the projected image of the original tracing is narrowed by the optical system. In passing through a shutter at the focal plane, the image length is reduced proportionally by the speed at which the sensitized material passes the shutter.

To operate the machine, the original tracing is fed into a front opening where it passes directly into the exposure area and is discharged into the receiving tray. Two optical paths from the exposure area to separate shutters on the focal plane make possible two separate reductions in size from 1:1 to 8:1. These reductions are dial-selected by the operator. A swinging mirror arrangement permits either right reading or reverse reading copy to be made.

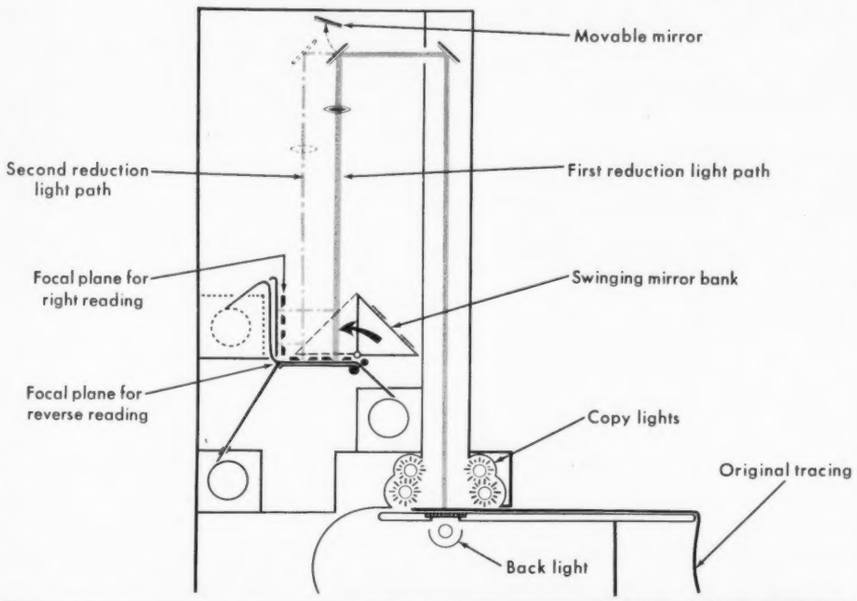
After the sensitized material is exposed, it is collected in a removable magazine for developing whenever convenient. Development takes place in a processing unit also on a continuous basis.

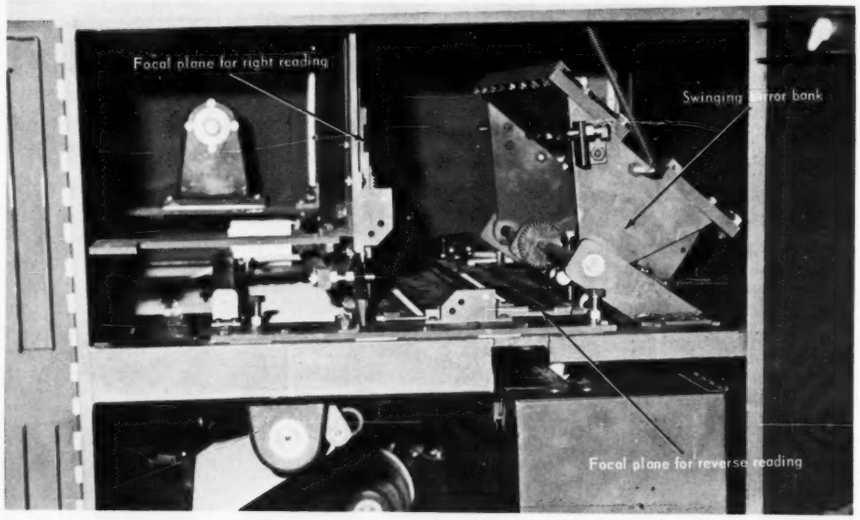
The reducing printer stands about 101 by 60 by 62 inches (including the work table). It handles originals at speeds of 3 to 30 fpm and sizes up to 42 inches wide.

The continuous reducing printer was developed by the Paragon-Revolute Div. of the Charles Bruning Co., Mt. Prospect, Ill.



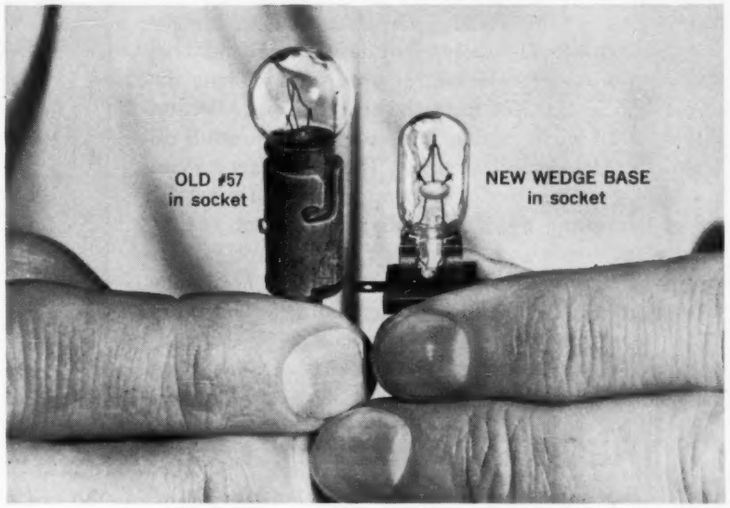
Coordinated in Reducing Printer





CONTINUOUS REDUCING PRINTER uses series of narrow belts to bring original tracing under copy flattener into exposure area. Lights available for illuminating original tracing consist of one set of four copy lights or back light. All can be controlled individually. First mirror in optical system reflects image 90 deg to movable mirror for primary reduction (or past movable mirror if it is in raised position) to another mirror for secondary reduction. Each set of mirrors for primary or secondary reductions has separate lens system to project correct reduced-sized image on focal plane. For reversed-reading transparency, image is projected through shutter to focal plane where sensitized material is moving horizontally past shutter slit. For right-reading transparencies, swinging mirror bank swings in place and reverses image which is now projected through shutters to vertical focal plane. Selecting required reduction on dial coordinates sensitized paper speed to match reduction in length with width.

NEW G-E "WEDGE BASE" LAMP SAVES SPACE, SAVES MONEY, SAVES TIME, SAVES MANPOWER



The new "Wedge Base", all-glass, incandescent indicator lamp is an exclusive G-E development designed to replace the old #57 and other similar bayonet-based lamps. It's available in 6.3 and 12 volts. See below.

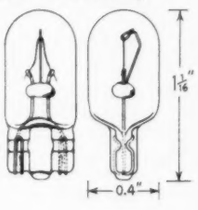
The Wedge Base saves space because, with its holder, it is considerably smaller than the old #57. It saves money because the holder and total installation costs are less. It saves time because the holder is easier to install and the lamp can be seated with just a push. And it saves manpower because installation can be automated and holders can be molded into plastic circuits. The G-E Wedge Base lamp can withstand ambient temperatures up to 600°F because it has no basing cement.

A major automobile manufacturer is already using G-E Wedge Base lamps; they're available in mass quantities. For more information write: General Electric Co., Miniature Lamp Department M-12, Nela Park, Cleveland 12, Ohio.

The Wedge Base is available in two ratings

G.E. Lamp No.	158	159
Circuit Volts	12	6.3
Amperes	0.24	0.15
Design Volts	14	6.3
Rated Av. Life at design volts	500 Hrs.	*
Filament	C-2V.	C-2R
L.C.L.	½"	½"
Bulb	T-3¼	T-3¼
Base Type	Wedge	Wedge
Candlepower	2	35

*In excess of 5000 hrs. at 6.6 volts



Progress Is Our Most Important Product

GENERAL ELECTRIC

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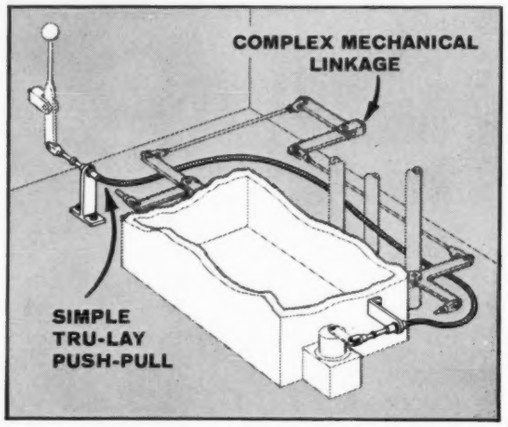
ACCURATE REMOTE CONTROL FOR HUNDREDS OF PRODUCTS

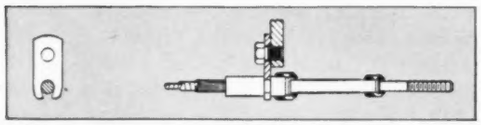
— — with Tru-Lay *PUSH*-PULL Controls

If your products involve remote control—electrical, hydraulic, pneumatic or direct—TRU-LAY PUSH-PULL FLEXIBLE CONTROLS can help solve your design problems. They provide positive remote control over short or long distances—up to 150 feet from the control point. Because they operate while flexing, they can snake around obstructions. They will not buckle. They are ruggedly constructed, easily installed and operated, sealed against dirt and moisture, and will handle jobs with as much as 1,000 lbs. input. PUSH-PULL CONTROLS are simple, have but one moving part, are noiseless and give a lifetime of accuracy. Mechanical linkages, on the other hand, are complex. Unlike PUSH-PULL CONTROLS, they are made of many parts, wear at many points, and produce increased backlash, vibration rattles and lost accuracy.

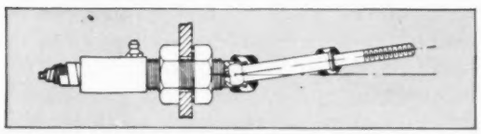


THESE FEATURES HELP SOLVE DESIGN PROBLEMS

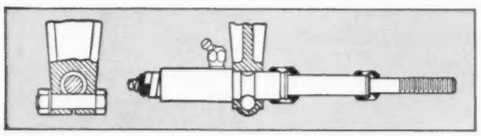
Anchorages



Clip anchorage • a simple clip for light loads

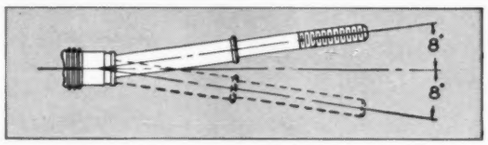


Bulkhead anchorage • for heavy-duty installations



Machined bracket anchorage • can be furnished for mounting any PUSH-PULL cable at the swivel terminal

Swivel Action



Standard assemblies have end fittings with a swivel movement of ± 8° to compensate for misalignment and rise or fall of lever arms. Swivel joints, and the sliding ends, are sealed against dirt and moisture.

***PUSH*-PULL DATA FILE SHOWS HOW TO SIMPLIFY, IMPROVE DESIGN**

• Write for your PUSH-PULL Data File. It contains a complete set of engineering bulletins which describe in detail the operation of PUSH-PULL CONTROLS, their applications, features and advantages.

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IDEAS . . .

MECHANICAL DEVICES

Cam Indexes to Cut

Edward W. Schrader, Western Editor

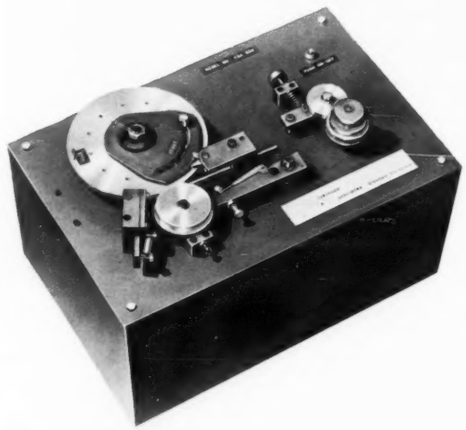
In an automatic wire cutter, the index wheel feeds the wire to the cutter by passing the wire between the index wheel and a roller. When the desired length of wire has passed under the index wheel, a trip pin turns a star wheel.

A cam mounted on the same shaft as the star wheel releases a spring-loaded cam follower pin, which in turn releases the guillotine. After cutting, the guillotine is repositioned by a reset cam which rotates on the same shaft as the index wheel.

Length of cut wire is adjusted on the front of the machine. The index pin is mounted on a vernier for close adjustment about any of the index holes on the index wheel.

The automatic cycle starts with the index pin tripping the star wheel. The star wheel rotates the three-sided cam to move a flat side down, thus raising the spring-loaded lift roller and allowing the wire to be engaged between the index wheel and its roller. The index wheel and roller then feed the wire through the machine.

When the trip pin trips the star wheel, the star rotates one position and the cam presents a point side to the lift roller. This action moves the lift roller down and releases the wire from the feed position. A second cam immediately arms



WIRE CUTTER produces 3600 pph for 20-inch lengths or 900 pph for 60-inch lengths of wire. It accommodates wire sizes from 26-gage to 12-gage. Cutting tolerance is ± 1/64-inch.

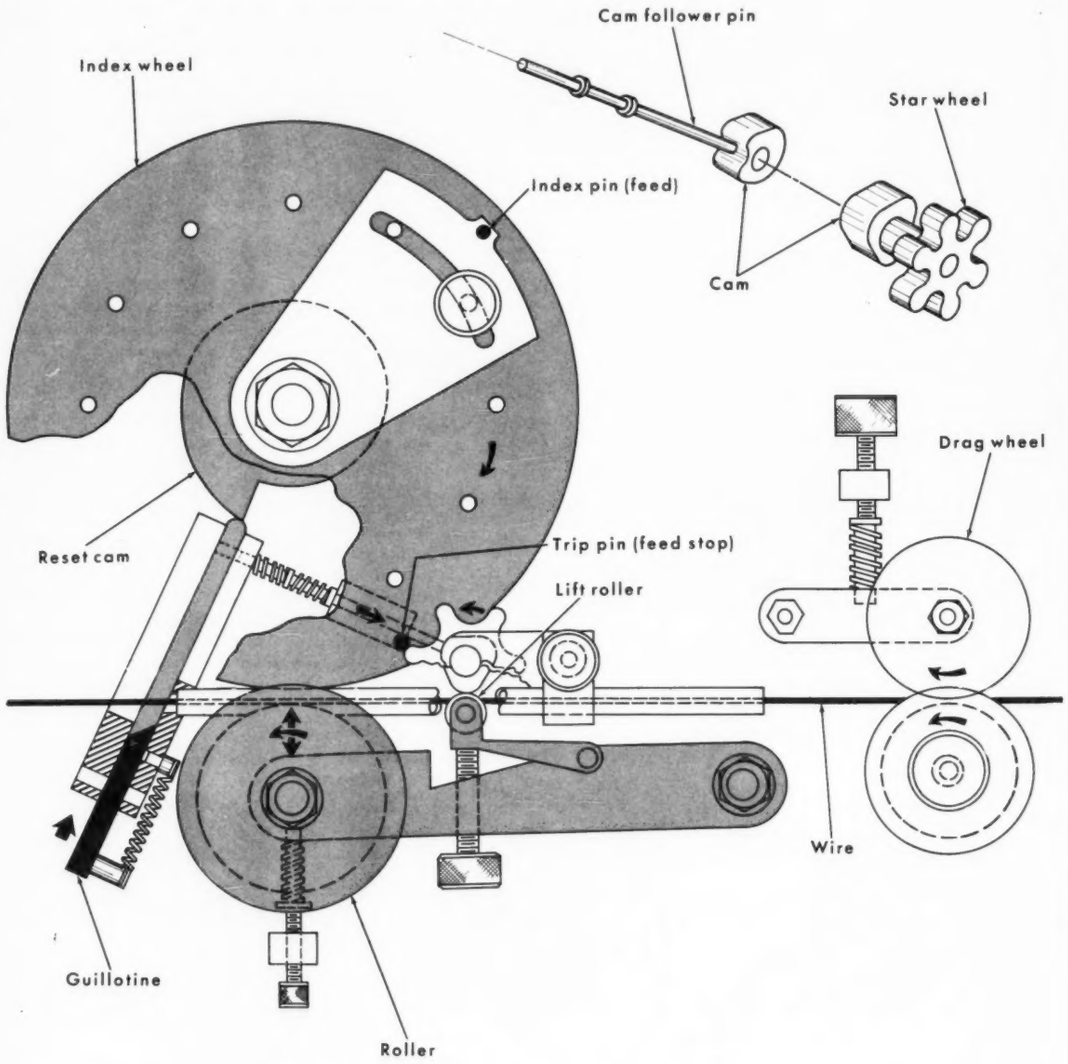
Wire Automatically

the guillotine, which moves upward when released by reset cam, cutting the wire to length.

The reset cam rotating with the index wheel returns the guillotine after the cutting operation to its normal position. It is registered carefully with the starting index pin so that the star wheel turns simultaneously with the resetting of the guillotine. The lift roller is permitted to rise, re-engaging the feed rolls and the cycle repeats.

A drag wheel, which is spring-loaded, applies the proper amount of friction drag to keep the wire under tension for the feed system.

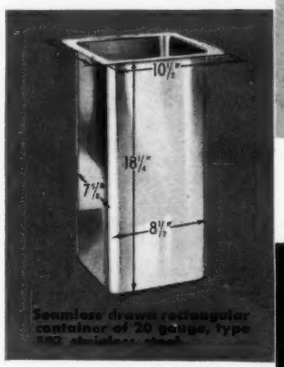
The Automatic Wire Cutter, Model CWA-300, is a design development of Dickinson & Associates, Glendale, Calif.



WIRE CUTTER produces wire lengths from 1 to 60 inches. Each 20-inch increment is adjusted by means of vernier and index holes on index wheel. For lengths in range of 20 to 40 inches, the three-sided cam is replaced by two hexagonal cams properly faced for raising lift roller and tripping cut-off follower.

No Tooling Cost To Draw Shapes Like These and dozens of others with **POLAR WARE Facilities**

Seamless drawn cylindrical container of 22 gauge steel.



Seamless drawn rectangular container of 20 gauge, type 302 stainless steel.

Seamless drawn oval container of 20 gauge, type 302 stainless steel.

■ It will pay you to check out your new design ideas with Polar Ware. The chances are good that our hundreds of existing dies, plus the facilities of our complete tool and die shop, can save you thousands of dollars in tool cost, plus weeks of waiting time. Difficult seamless deep drawing work in stainless steel is our specialty, in gauges from 3 to 30; also carbon steel and aluminum. Take advantage of our more than 50 years' experience in metalworking. Without obligation, send your inquiry to the Contract Department.

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Spincraft reaches new heights

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Spincraft has long been a prime source of expert counsel and skilled craftsmanship for the nation's astrophysicists. It was natural, therefore, for the designers of these gondolas to call upon Spincraft for the intricate fabrication of metal parts.

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Write for Spincraft's *Notes for an Engineer's File*, a series of bulletins to keep you abreast of the latest metal spinning advances at Spincraft — the world's largest metal spinning plant.

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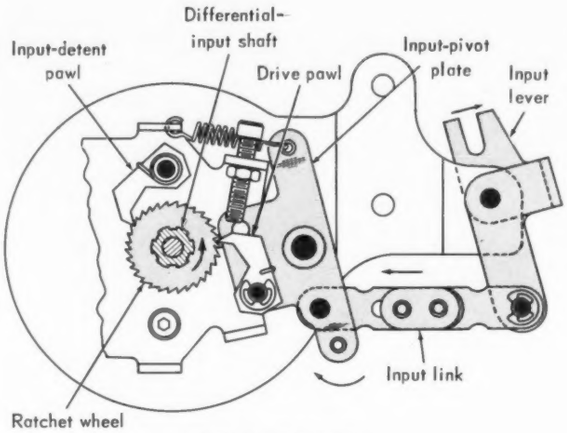
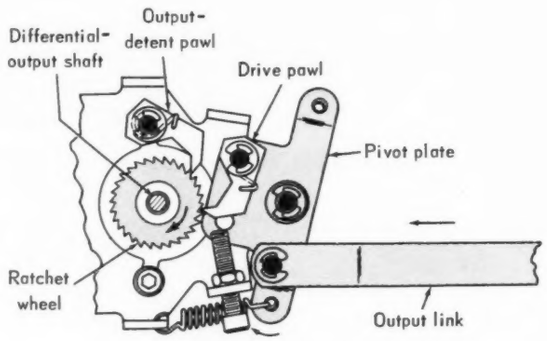
Differential Mechanism Counts

Lars G. Soderholm, Midwest Editor



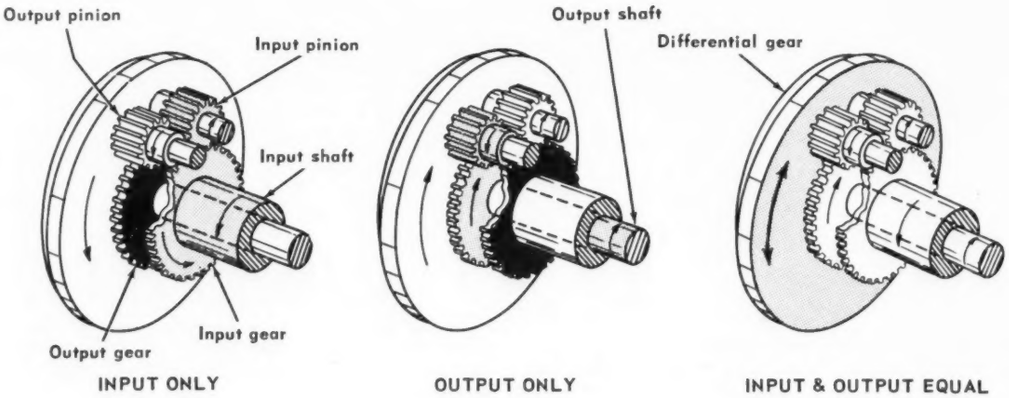
INPUT MECHANISM

INPUT AND OUTPUT MECHANISMS operate with every code group received or transmitted. When message is received, reperforator input lever transmits movement to input pivot plate. Input pivot plate causes drive pawl to rotate ratchet wheel counterclockwise one tooth per code group. Rotation of ratchet wheel is transferred to hollow differential input shaft. When message is sent, cam on transmitter camshaft drives output mechanism. Two-lobe cam actuates output link which causes output pivot plate and attached drive pawl to turn output ratchet wheel in clockwise direction. Rotation of ratchet wheel is transferred to differential output shaft which passes through hollow input shaft.



OUTPUT MECHANISM

DIFFERENTIAL MECHANISM converts input and output motions into single directional movement. When only the reperforator operates, input shaft turns input gear and mating pinion. Since input and output pinions mesh with each other, output gear, locked in position by detent pawl, forces output pinion to walk around it in counterclockwise direction. Pinions are fastened to differential gear which follows them. When only transmitter operates, output shaft rotates, turning output gear and pinion. Locked input gear now causes input pinion to walk clockwise around it carrying differential gear with it. When both motions occur simultaneously, higher speed pinion is partially neutralized by slower speed pinion. Resultant speed and direction of rotation of differential gear is equal to difference in speed of pinions and in direction of higher speed pinion.

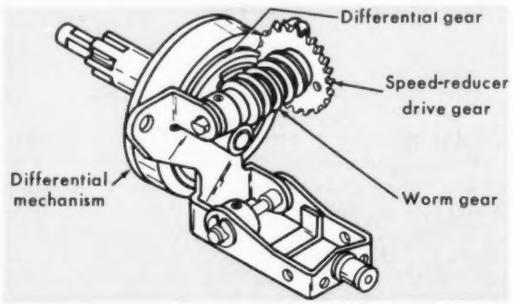


INPUT ONLY | OUTPUT ONLY | INPUT & OUTPUT EQUAL

In-Out Messages, Tells Difference

A tape storage indicator uses a differential mechanism to combine input motions from messages received and output motions from messages transmitted into a single movement which is a function of the difference. This difference is registered on an indicator dial as the amount of tape in the storage bin.

Tape storage indicators are used on the reperforator-transmitters in a teletypewriter system to show how much tape is in bin between reperforator and transmitter. The tape storage indicator permits one person to check a large number of units.

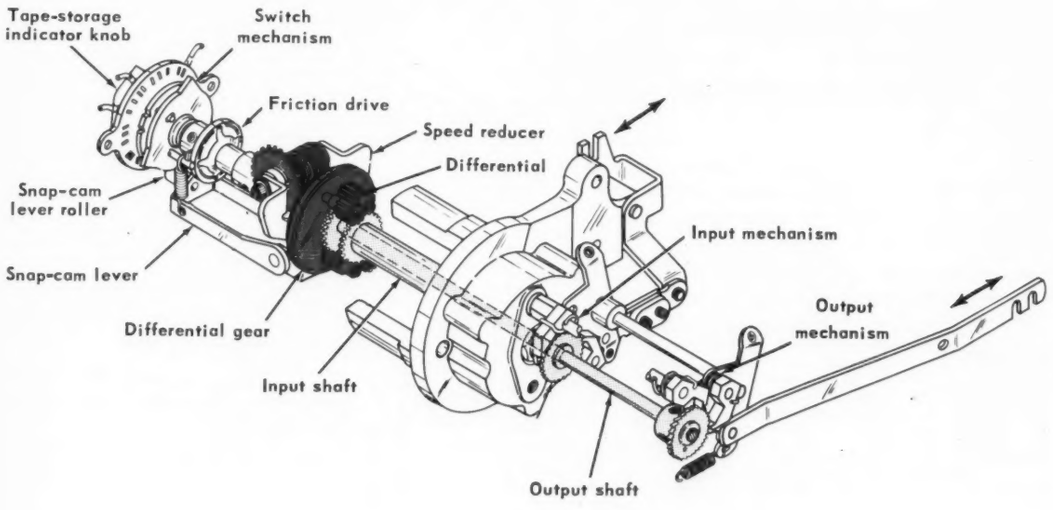


SPEED REDUCER MECHANISM is driven by differential gear. Speed reducer drive gear engages single spiral gear tooth on face of differential gear. Drive gear is fastened to worm gear and, as drive gear rotates, worm gear rotates with it. Worm gear engages helical gear on indicator shaft. Combined speed reduction is 300:1. Tape storage capacity is 150 ft of message tape.

The tape storage indicator consists of an input and output mechanism, differential, speed reducer, friction drive and a switch mechanism. The input and output mechanism operates whenever a message is received or transmitted. Both movements are fed into the differential and combined into rotational movement. Both the direction and amount of rotation are a measure of the difference between the input and output movements.

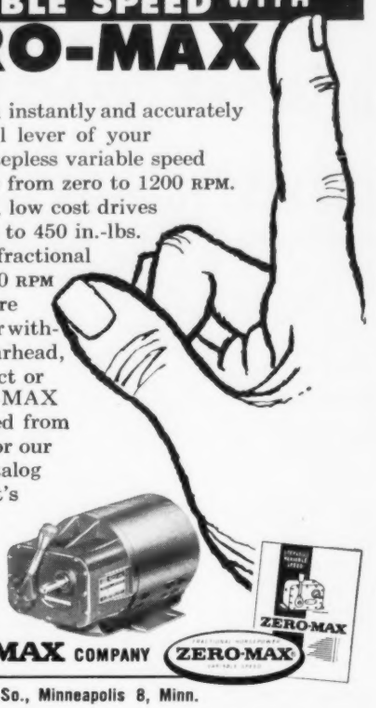
A speed reducer is used to provide the required final speed. The friction drive prevents damage to the tape storage indicator mechanism and permits the tape storage indicator to be reset manually. The switch mechanism closes circuits when the tape storage indicator shows 50 ft of tape and 100 ft of tape in storage. As the circuit is closed, an alarm sounds to alert the operator to the amount of tape in the storage bin.

The tape storage indicator mechanism was developed at the Kleinschmidt Div. of Smith-Corona Marchant, Inc., Deerfield, Ill.



FINGERTIP CONTROL GIVES
VARIABLE SPEED WITH
ZERO-MAX

A finger's touch instantly and accurately sets the control lever of your ZERO-MAX stepless variable speed drive anywhere from zero to 1200 RPM. These compact, low cost drives produce from 3 to 450 in.-lbs. of torque with fractional horsepower 1800 RPM motors. They are available with or without reverse, gearhead, safety disconnect or motors. ZERO-MAX drives are priced from $45.00. Write for our free 16-page catalog or refer to Sweet's Product Design File.



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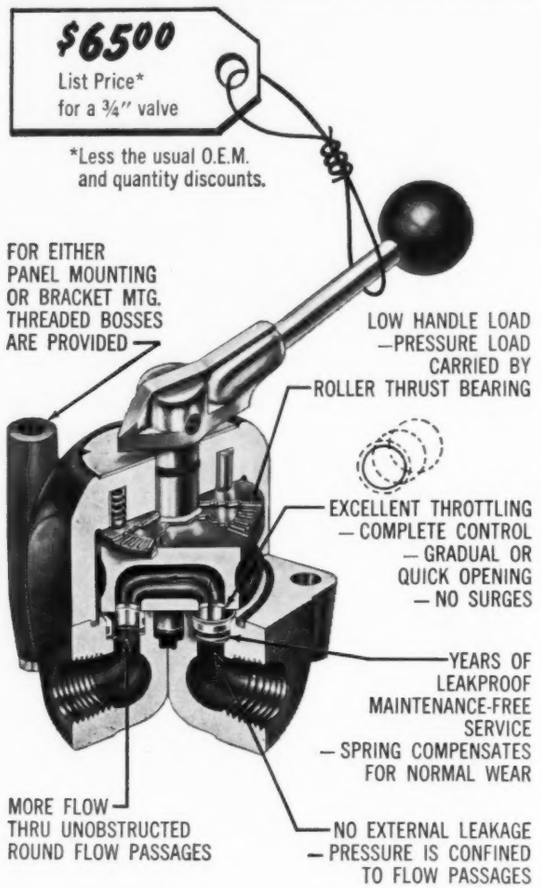
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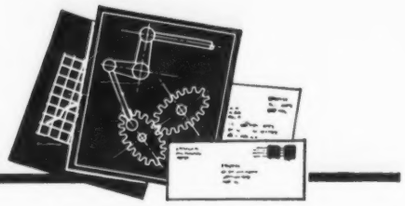
IDEA MART

DESIGN NEWS



DESIRED

New Product Ideas

As the Stamping Div. of a large corporation, we are always on the alert for new product possibilities which have a good potential for bringing adequate return and fulfilling the needs of available plant facilities in our division or other phases of our organization.

We are interested in any proprietary items which can be made out of metallic materials through use of punch presses and welding equipment with secondary operations. This can be an electromechanical device. We prefer items sold to the O.E.M. market; however, we are not precluding opportunities that might be desirable for the consumer market.

Our organization, in addition to job stampings, also has facilities for forgings, universal joints, brakes, springs, axles, transmissions, bumpers, seat cushions, gas and liquid filters and grating.

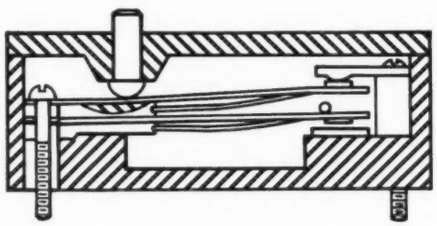
We will consider only items that have patents applied for or granted. Substantial capital investment is no deterrent factor since it is our feeling that the investment involved restricts the amount of competition. Write C-43, Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.

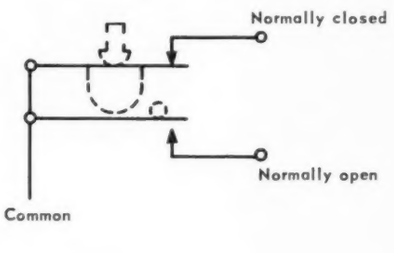
AVAILABLE

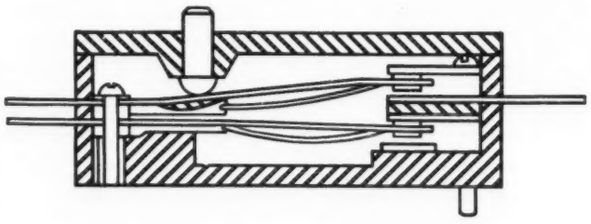
Snap-Action Switch

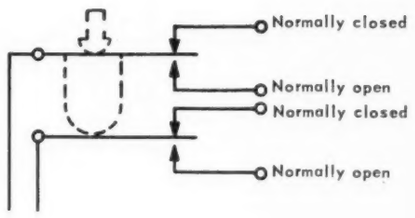
This switch has a three-position actuator. Neutral position includes: "on", "neutral", then "on". The "on" position is spring-returned to the original "on" position when pressure is removed as with a standard single-pole, double-pole snap-action switch.

This is a truly neutral position switch. It is particularly adaptable for cam operation and, in many applications, will result in one less switch and cam required to perform a specific switching function. For example, the common impulse timer switches used on automatic washing machines utilize a neutral position on approximately half of their cams and cam switch springs, but this switch can operate on a constant-speed cam providing its own built-in snap action as with any other snap switch. Write J. B. G., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.





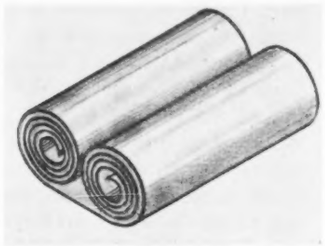




AVAILABLE

Flexible Elastic Sheeting

Flexible elastic sheeting, suitable for covers for such items as office equipment or any item that requires protective covering, has a normal rolled-up position. It may be stretched out to cover any object and be retained in place under sides or part or by suitable catches. When unfastened the sheeting will snap back automatically and will stay in a rolled-up condition. Write H. B., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.

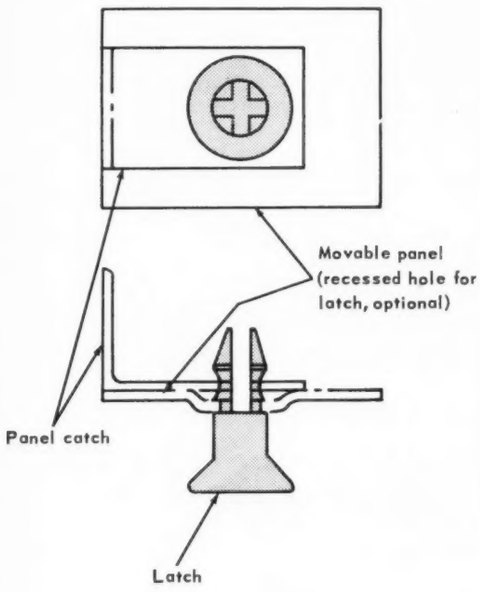


Push-Pull One-Piece Latch

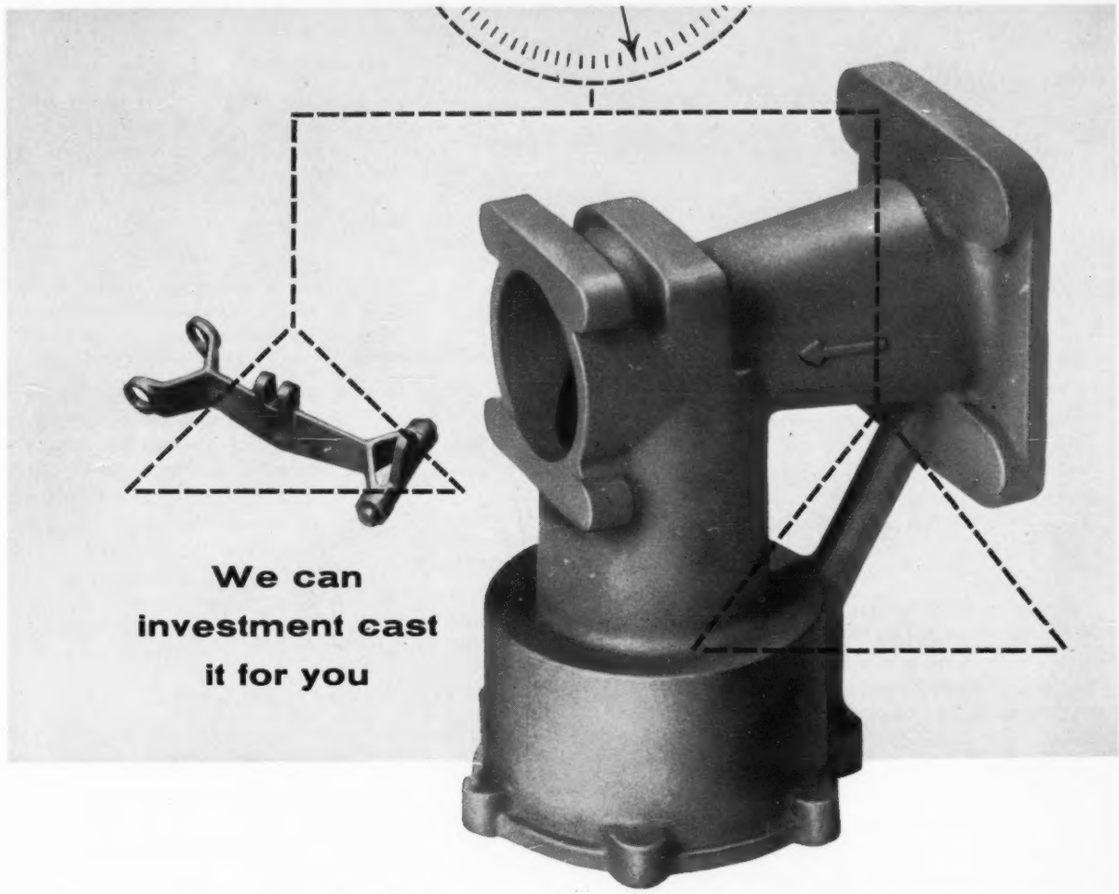
This one-piece molded or machined latch, made of nylon, is installed quickly in a movable panel or door by pushing it into a hole until the second groove of the latch snaps into the hole. It is then permanently held.

A panel catch with the same size hole as the removable panel is then engaged by pushing on the knob of the latch or by pushing on the panel itself. The latch engages the hole and is held by friction as it cams itself into position due to taper in first groove.

A pull on the knob will open the door or drawer in which this latch is installed. Wish to sell or license invention. Write H. E. K., Idea Mart, DESIGN NEWS, 20 N. Wacker Dr., Chicago 6, Ill.



WHETHER YOUR PART IS TINY... OR WEIGHS 100 POUNDS...



Today, no matter how large the part on your drawing board . . . whether it weighs a few ounces or as much as 100 pounds . . . Arwood can investment cast it. It makes no difference what the metal or alloy is. We cast all castable materials, ferrous and non-ferrous, including magnesium. So now you can reap the benefits of investment casting in the broadest range of part sizes, weights and materials ever. Benefits like freedom to specify the best possible metal for the job . . . sharply reduced production costs on complex shapes . . . quick, inexpensive tooling in design development work.

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Write for your free copy of our 44-page booklet, "Practical Guide to Investment Casting."

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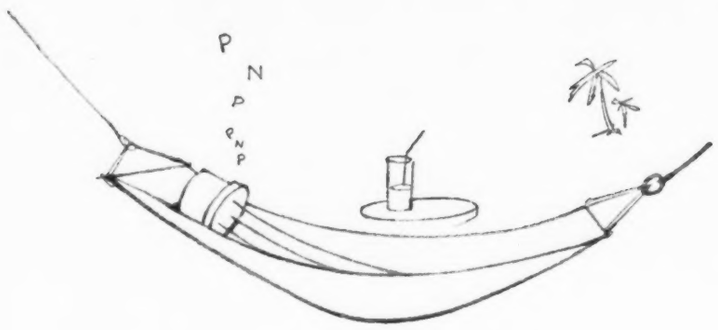

taking the overload off

The trouble with using fuses to protect transistors from short period overloads or fault currents is simple: the transistor is by far the better (and faster) fuse. It can also be called too much "thermal inertia" on the part of the fuse, but the transistor still ends up the same way.

As fate* would have it, a prominent relay manufacturer has now come to the rescue. We've devised a simple little 3-terminal device that will prevent destruction of transistors by DC overloads. It's working in customers' equipment, and

- — operates in 1 to 5 milliseconds
- — limits the transient, with a complete short circuit, to a maximum of 5 times the set value
- — interrupts currents up to 5 amperes
- — can be reset (locally or remotely) or designed to cycle
- — will operate a local or remote warning light, buzzer, etc.
- — can be supplied in a wide variety of set points

*and our New Business Program

— operates within +20% of its set point
— doesn't cost all outdoors

You do have to allow for the resistance this overload protector introduces into the circuit, but it's in the order of 1 to 5 ohms and the voltage drop is a few millivolts, less than one-tenth the voltage drop of the conventional circuit breaker.

To those who might question the economics of spending more than the transistor's cost just to protect it, keep the alternatives in mind. If the burned out transistor(s) lets a machine produce a carload of 4-foot yardsticks or causes a few hours of expensive down time, the protection is cheap. (Ever rented a computer?)

If you'd like some block diagrams of typical uses and an assortment of representative values and ratings, write to us, care of our Current Fault Division.

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AN AFFILIATE OF THE FISHER-PIERCE CO.

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PATENTS

Quick-Disconnect Coupling

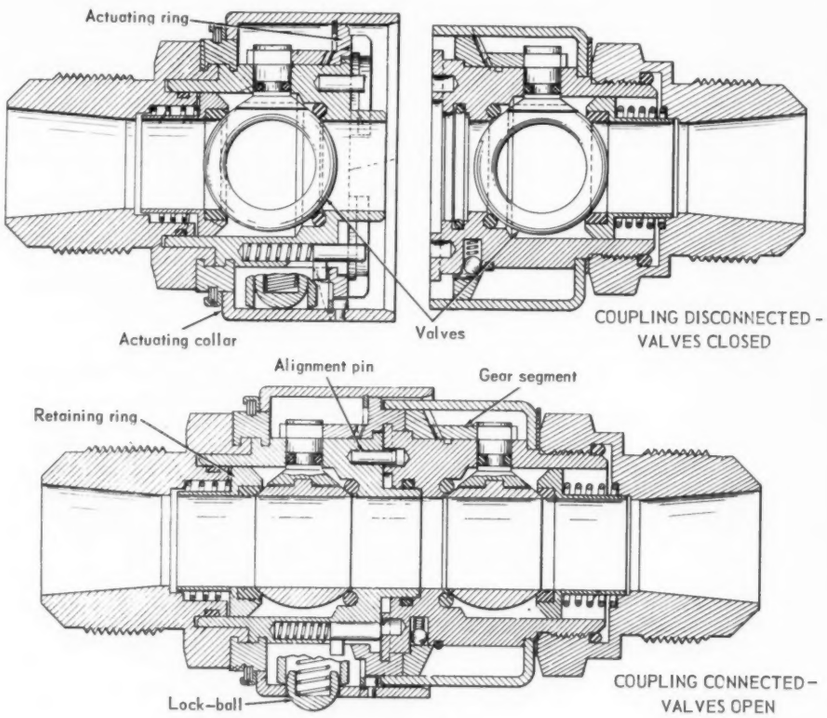
U. S. Patent 2,948,553; Vincent A. Gill and Harrison J. Britton, assigned in part to The Weatherhead Co., Cleveland, Ohio.

The spherical-ball check valves in each portion of this quick-disconnect coupling have a bore diameter equal to the internal diameter of the lines. Thus, a straight-through tubing effect with minimum pressure drop is obtained. Comparatively high fluid pressure can be used with a minimum of leakage. Valves are locked in a closed position when the coupling is disconnected.

One portion of the coupling takes the form of a nipple; the other the form of a socket. The spherical valves may be rotated about an axis perpendicular to the coupling axis by means of a short O-ring sealed shaft. A gear segment is connected to the short shaft, a tonque and groove between each valve and its shaft is provided with slight clearance to allow movement of the valve. An O-ring is positioned between the valve and the body to form a seal, and a retainer ring is mated to the opposite side of the valve by a compression spring.

A swivel connection is provided between the coupling body and fitting so the body may be rotated with respect to the fitting. A connecting and valve actuating ring is provided on one face with a segment of gear teeth extending 90 deg around the circumference. The ring is positioned with respect to the valve shaft segment so that teeth are in mesh at all times. On the opposite face of the ring are four equally spaced lugs, each provided with a stop formed by swaging one edge downward.

To lock the valves of both members in open position when the members are connected, a radially extending short sleeve is provided with a spring-loaded lock ball. It engages the inside wall of a collar. When the collar rotates with respect to the body, the ball will enter an aperture formed in the collar.



The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

HYDRAULIC TRANSMISSION
U S Patent 2,961,829; Charles O. Weisenbach, assignor to The New York Air Brake Co., New York, N. Y.

DEVICE FOR SENSING BEARING TEMPERATURE
U S Patent 2,961,875; Kurt F. Reumund, assignor to Westinghouse Electric Corp., East Pittsburgh, Pa.

INTERMITTENT MOTION DRIVE MECHANISM
U S Patent 2,961,879; Vincent L. Hudson, assignor to International Business Machines Corp., New York, N. Y.

MULTIPLE SPEED TRANSMISSION
U S Patent 2,961,885; Lonnie M. Dunn, Anaheim, Calif., and William N. Brummett, Reseda, Calif.

ROLLER-TYPE LINEAR ACTUATOR
U S Patent 2,961,887; Marshall Long, Overland Park, Kan.

POWER TRANSMISSION DEVICE
U S Patent 2,961,892; Ernst W. Spannhake, assignor to LeTourneau-Westinghouse Co., Peoria, Ill.

VIBRATION DAMPER
U S Patent 2,961,894; John S. Oles, Detroit, Mich.

TWO-STAGE HYDRAULIC SERVO VALVE
U S Patent 2,962,002; Paul F. Hayner, assignor to Sanders Associates, Inc., Nashua, N. H.

IMPACT AND TEMPERATURE RESPONSIVE VALVE
U S Patent 2,962,035; George W. Wright, John C. Kerr and Burdette W. Foss, assignors to Tokheim Corp., Ft. Wayne, Ind.

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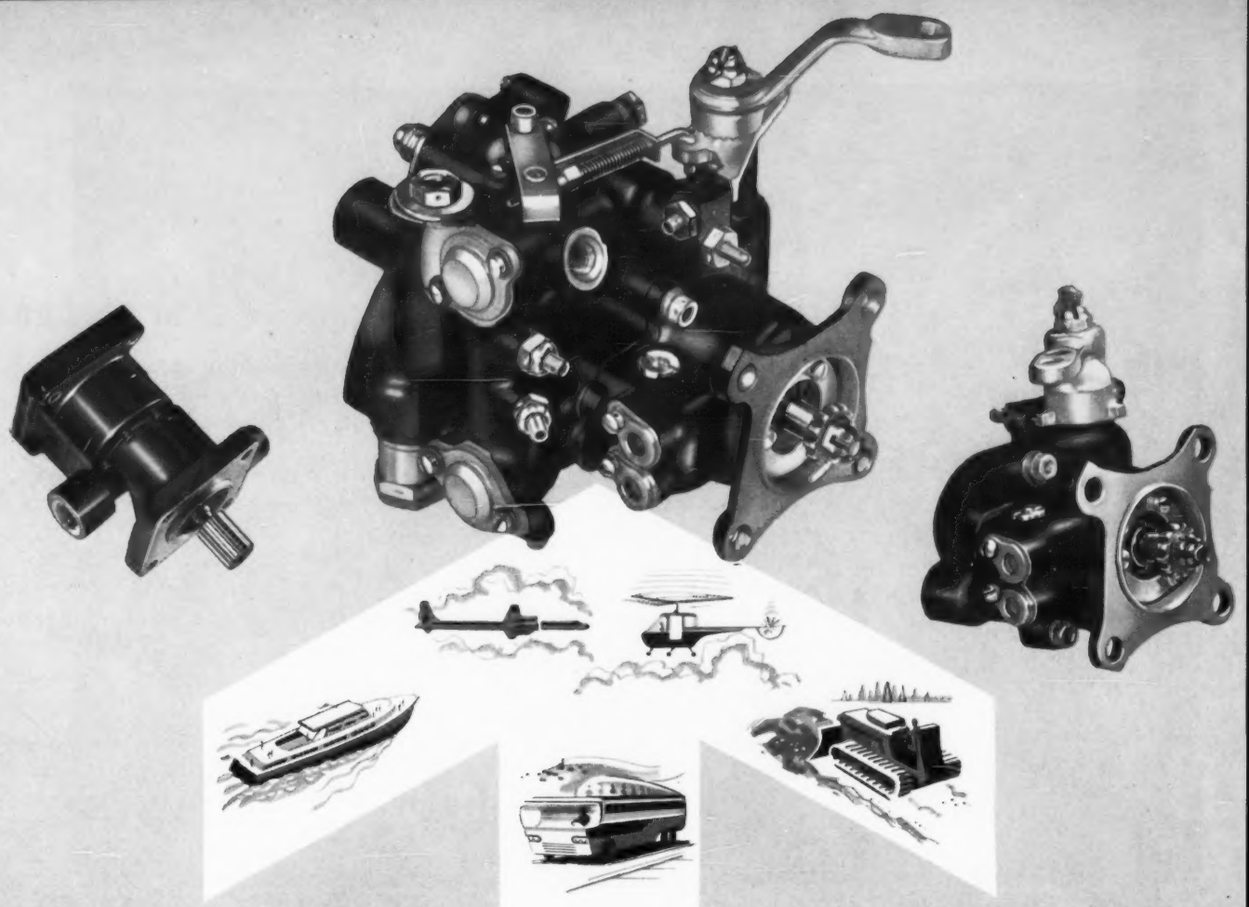

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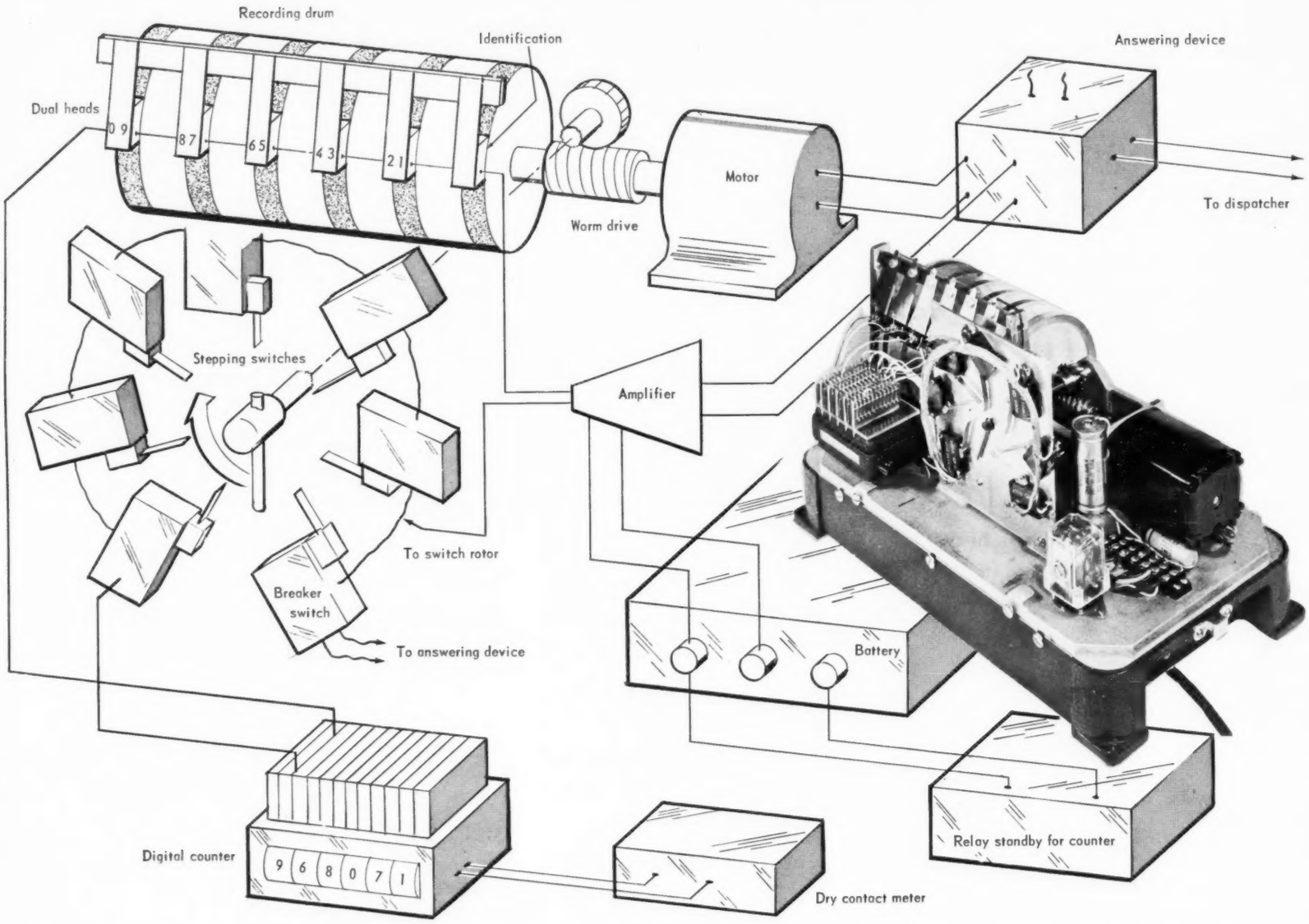
Bendix PRODUCTS DIVISION South Bend, IND.

Recording Drum Translates Unit Count to Spoken Message

E. J. Stefanides, Central States Editor



ELECTROMECHANICAL D-A-T-A UNIT, (Digital-to-Audio-Translater-Accumulator), is powered by 115v a-c, has emergency battery circuit in event of power failure. Counting unit is actuated by dry contact in meter or other count-sensing device. Count is stored by contact strip assembly of counter. Incoming call signal actuates telephone-answering switch device. As drum revolves, worm-gear-driven stepping switch connects playback head of station identification tape into amplifier circuit during first revolution, thus reading out spoken station identification. On successive revolutions, contact strips of consecutive channels of counter are connected into circuit. Position of strips selects proper playback channel of dual heads to read out proper digit in spoken form. Last switch terminates readout action and breaks phone circuit.

For Free Reprints of the Above Article, Circle 528 on Reader-Service Card

A new device for accumulating and transmitting flow or unit-count data from field locations to a central dispatching or recording point uses a tape-recording drum to translate the accumulated data into a spoken readout. The resulting information can be transmitted over leased wire, microwave systems or by commercial telephone lines.

This device was developed to provide a simple, inexpensive method for getting accurate up-to-the-minute readings of pipe line flow from remote field stations to the dispatching personnel. To secure the information, the dispatcher dials the field station phone number. This automatically sets the system in operation, causing it to give a spoken readout of the station identification and the unit count at that moment. A typical message is "Cherokee 374240".

The heart of this device is the recorded message drum. This is a plastic drum having six pre-recorded channel magnetic tapes cemented to its periphery. One tape carries the voice recording of the station identification. The other five carry two recorded digits each (one on each edge of the tape), from zero to nine.

The drum is powered by a universal electric motor. The incoming call actuates a telephone answering switching device to start the motor and connect the playback amplifier into the line.

The revolving drum carries the tapes beneath double-channel magnetic pickup heads. A stepping switch, driven from the drum shaft by worm gearing, connects one pickup channel of dual playback head to the amplifier during each revolution, thus reading the station identification, or one digit per revolution. Selection of the playback channel which determines digit readout is accomplished by consecutively switching the contact strips of an electrically operated digital counter into circuit. The contact strip position determines the digit readout.

The idea and original design of this electromechanical device was by the Communication Dept. of the Marathon Pipe Line Co., Findlay, Ohio, a subsidiary of The Ohio Oil Co. The final design and packaging of the unit was done by Continental Technical Service, Inc., Dayton, Ohio, that is manufacturing and marketing the device under agreement with Marathon.

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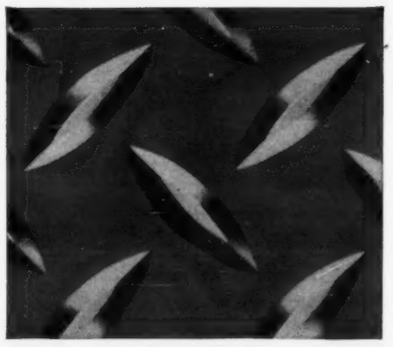
Alan Wood Super Diamond floor plate sheds dirt and water quickly

Sweep it, hose it or mop it—A. W. Super Diamond rolled steel floor plate has no pockets to hold dirt or water. The perfectly designed pattern of Super Diamond makes it the easiest-cleaning floor plate on the market today. You can shear, form, weld and match this floor plate wherever necessary, and the unique arrangement of the pattern allows you to bend it any place.

Super Diamond has many other advantages, too . . . an easily matched well-known design pattern . . . and readily available from warehouses. It wears indefinitely, with no chipping, cracking or splintering. And feet get traction from *every* direction, even when plates are wet.

For safety . . . for easy installation . . . for long wear . . . specify Alan Wood Super Diamond. Write for Bulletin SD-S1.



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NEW PRODUCTS

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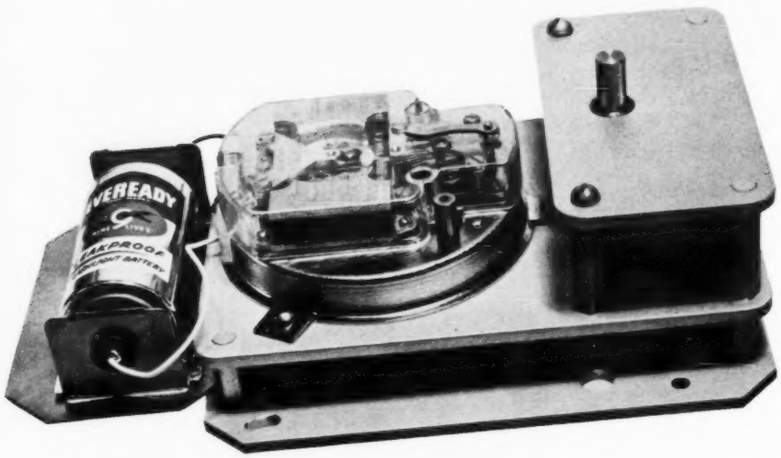
MECHANICAL

Chronometrically Governed D-C Motor 301

Operates from Standard Flashlight Cell



Accuracy and life of this unit are independent of load, line and temperature variations. This unit is available for applications requiring high accuracy and low current drain—for example, operating contacts, cams and actuators where loads are larger and vary over greater limits than escapement type can handle. The 1.5v motor operates for more than two years on a standard flashlight battery, and when used as a clock drive, a constant speed of 150 rpm is maintained by governor's balance wheel. This wheel is a hairspring mechanism, with an accuracy of ±10 seconds in 24 hrs—an accuracy of 1/50th of 1 percent—even with an input voltage range from 0.9 to 1.8v. Controlled by a jeweled escapement, governor's design causes motor circuit to be constantly pulsed at intervals; therefore, when battery voltage is high, motor rotor attempts to turn rapidly but shuts off its own current at frequent intervals to automatically compensate for high voltage. When voltage is low, current flows to rotor for longer periods, maintaining average speed. Rated speed is maintained with accuracy specified, despite wide line voltage variations. Weighing 3 oz and measuring 1¾ by 2½ by ½ inch, the unit is available with voltages ranging from 0.5 to 12v d-c.

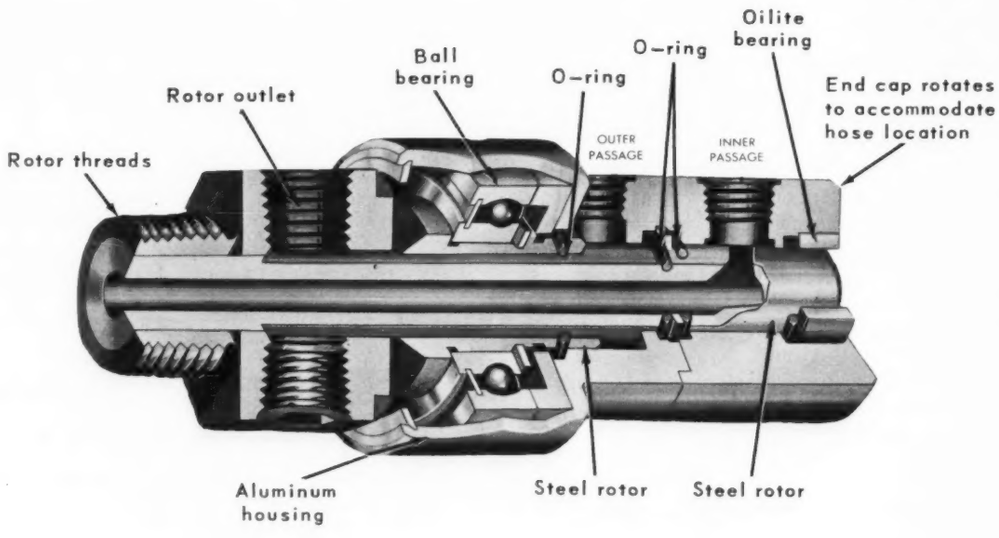
A. W. Haydon Co., Waterbury, Conn.

Double-Passage Rotating Union 302

Rated at 150 PSI Air, 1000 PSI Oil

Operations requiring a low-cost double-passage conveyance of air, hydraulic oil or other materials are design applications of the model 1595 slow-speed union. The unit is rated at 150 psi air passage, 1000 psi hydraulic oil, with rotational shaft speeds up to 200 rpm. It is applicable to rotating cylinders that require pressure to either side of a piston. Designs which require two air clutches on the same shaft with entrance from only one end is another application which this union fulfills. Under slow-speed conditions, O-ring construction provides a leakproof seal for economical and trouble-free service. A ball bearing and an Oilite sleeve bearing are used to eliminate radial load on O-ring; therefore, it is not required to act as a bearing. Housing is fabricated from aluminum bar stock for strength and to eliminate any possibility of porosity. Entrance connections are located to prevent abnormal thrust loads.

Deublin Co., 1919 Stanley St., Northbrook, Ill.



Electromagnetic Brake 303

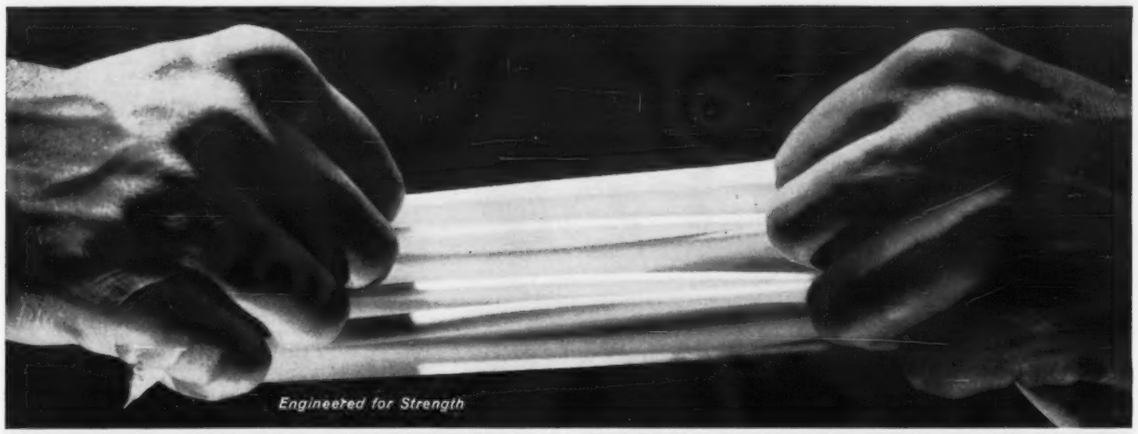
Offers High Torque Capacity, Compact Size

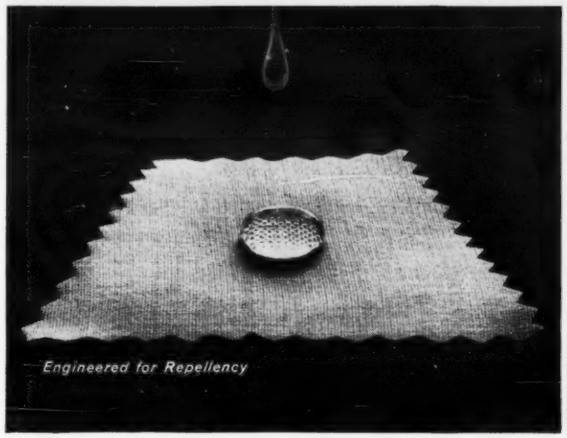
A magnetic brake with a high torque-versus-size ratio incorporates power-applied principle usually associated with multiple-disc type electromagnetic clutches. Friction plates are isolated from mag-

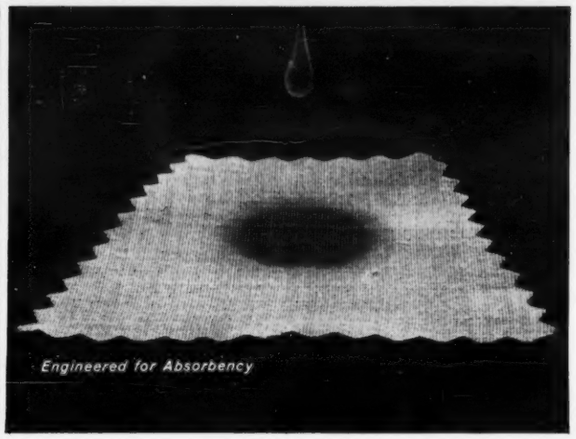
netic field, permitting high torque capacity and good control. Engagement is fast, smooth and shock-free (according to manufacturer). The unit has good heat-dissipation characteristics and torque is not affected by speed of engagement. Brake has a non-magnetic mounting flange. It is provided with both inside and outside pilot register. It may be flange or shaft-mounted for through-shaft or shaft-end use. The device may be operated in oil or dry without alteration. Twelve standard sizes range in diameter from 2.25 to 11.5 inches, with torque ratings from 35 to 32,500 lb-in.

Fawick Magnetic, Dept. of Fawick Corp., Airflex Div., 9919 Clinton Rd., Cleveland 11, Ohio.

An example of Avisco Rayons in Industry







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The big news in industry today is the increasing use of Avisco rayon fibers. Versatility is the reason. Avisco rayon can be custom engineered to meet your end-use requirements.

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Differentially Coupled Clutches 304

The input and output shafts and the 1.062-inch diameter mounting pilot are located at one end of the model 201-100-1 clutch-brake combination. The 0.375-inch diameter input shaft may be driven in one direction continuously while the 0.187-inch output shaft remains stationary or is driven in either direction, depending on which of the three sets of terminals are electrically energized. In event of a power failure, brake unit locks output shaft to housing with zero backlash grip. This unit features all stainless-steel design for maximum humidity and salt spray resistance; and

molybdenum disulphide impregnated sleeve bearings throughout for smooth operation and long life. Coil terminations are made inside unit to eliminate accidental damage by user when making electrical connections. Moving elements inside unit are designed so that wear of friction facings does not impair operation of clutches. Weight of unit pictured is 16 oz. Normally wound for 24 to 28v d-c, units are obtainable in other voltages.

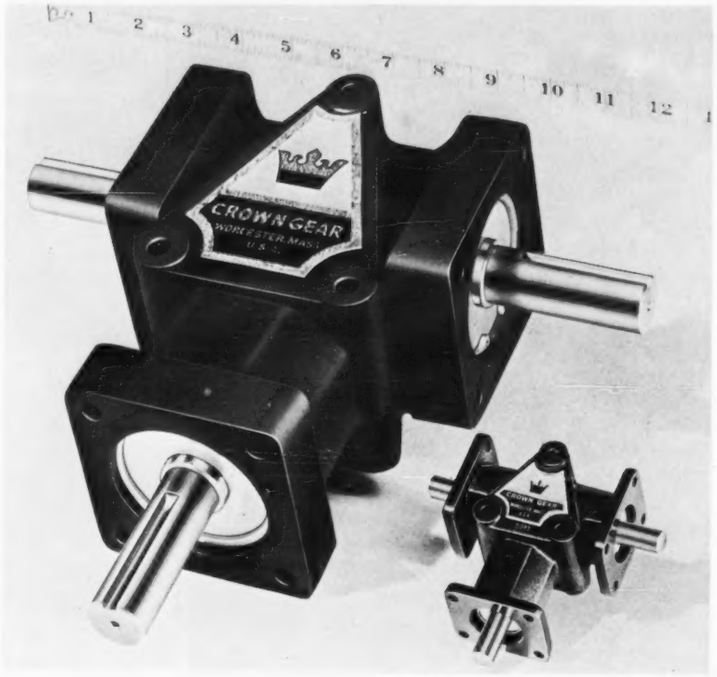
Marketing Computers, Inc., 50 St. Benedict, Florissant, Mo.

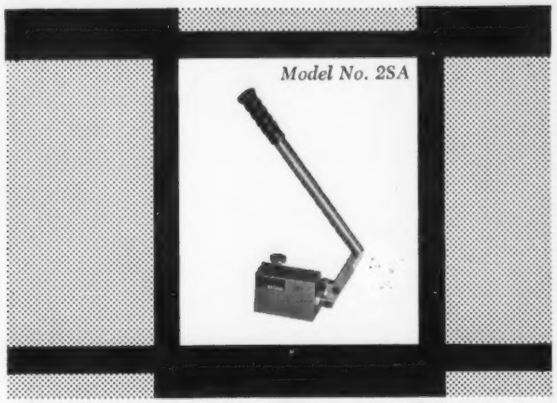
Packaged Gear Units

305

Right-angle power packs deliver 8 hp at 1100 rpm. Design engineers who have found the "package" concept best as a quick, efficient and economical solution of right-angle problems are now able to apply this to heavy-duty applications. Design specifications include: weight, 18 lb; housing, 6½ by 8¼ by 4 inches; shaft extensions, 2¾ inches; and shaft diameter, 1 inch. The 803 incorporates 8620 hardened spiral bevel gears, double-sealed ball bearings and stainless-steel shafts. It has five surfaces to provide flexibility in mounting the 356 aluminum-alloy housing.

Harrington & Richardson, Inc., Crown Gear Div., Worcester 10, Mass.





Automatic Dual Stage Hand Pump

• to 10,000 psi • automatic pressure compensated change from high volume to high pressure at preselected pressure point • built-in check valves, release screw and safety overload valve • ⅜", ½" and ¾" pistons • also available in Mil-spec series

The Model 2SA pumps on both the up and down cycles. When preselected pressure is reached, the up cycle (high volume, low pressure) cancels out and effort is exerted only on the down cycle (high pressure, low volume). Pump drilled for base or panel mounting. Built-in anti-cavitation features.

For further information contact

WILLIAM S. PINE

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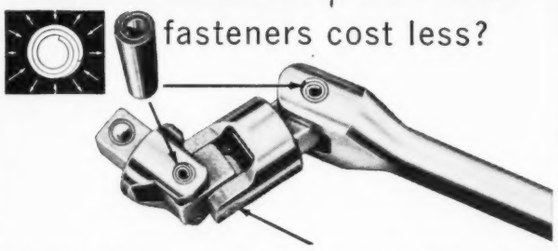
Why do

SPIROL *the true spring* **PIN**

fasteners cost less?



1. 80% of spring pin applications only require Medium Duty SPIROL PINS, which cost less.
2. Even the Heavy Duty SPIROL PINS in this socket-wrench universal joint don't cost more than other types of spring pins.
3. Assembly costs are lowered with SPIROL PINS! Just drill the hole (plus and minus tolerances allowed only by SPIROL PIN) and drive the pins—automatically or by hand.
4. Medium and Light Duty SPIROL PINS replace more costly fasteners, even in materials where other spring pins cannot be used. Come in Miniature Diameters, too: 1/32" to .052".

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ROD END INTERNAL THREAD TYPE "DREF" SERIES

ROD END EXTERNAL THREAD TYPE "DREM" SERIES

Combine "Monoball"® Engineering Advantages with Life-Time Lubrication

Design engineers in many industries are specifying new "DYFLON"® SELF-ALIGNING and SELF-LUBRICATING SPHERICAL BEARINGS for these 5 major reasons:

1. **LOWER COEFFICIENT OF FRICTION** ...ideal where lubrication is impossible or undesirable.
2. **WITHSTAND EXTREME VIBRATION** ...perfect performance under shock load conditions.
3. **WILL NOT "COLD-FLOW"** ...even under extreme load conditions.
4. **IMPERVIOUS TO KNOWN CHEMICAL SOLVENTS** ...eliminates corrosion problems.
5. **FAIL-SAFE** ...due to "Monoball"® design.

Request Engineering manual No. 551.

In addition, due to their two-piece "MONOBALL"® design and plastic alloy insert, "DYFLON"® bearings have a long cycle life. Alignment and installation problems are minimized. Oil-free for life means lowest possible maintenance costs.

Available in a variety of plain or rod end types. Bore sizes to 3.000". Materials include stainless steel, plastic alloys and chrome alloy steels. Ultimate static loads to 500,000 lbs.

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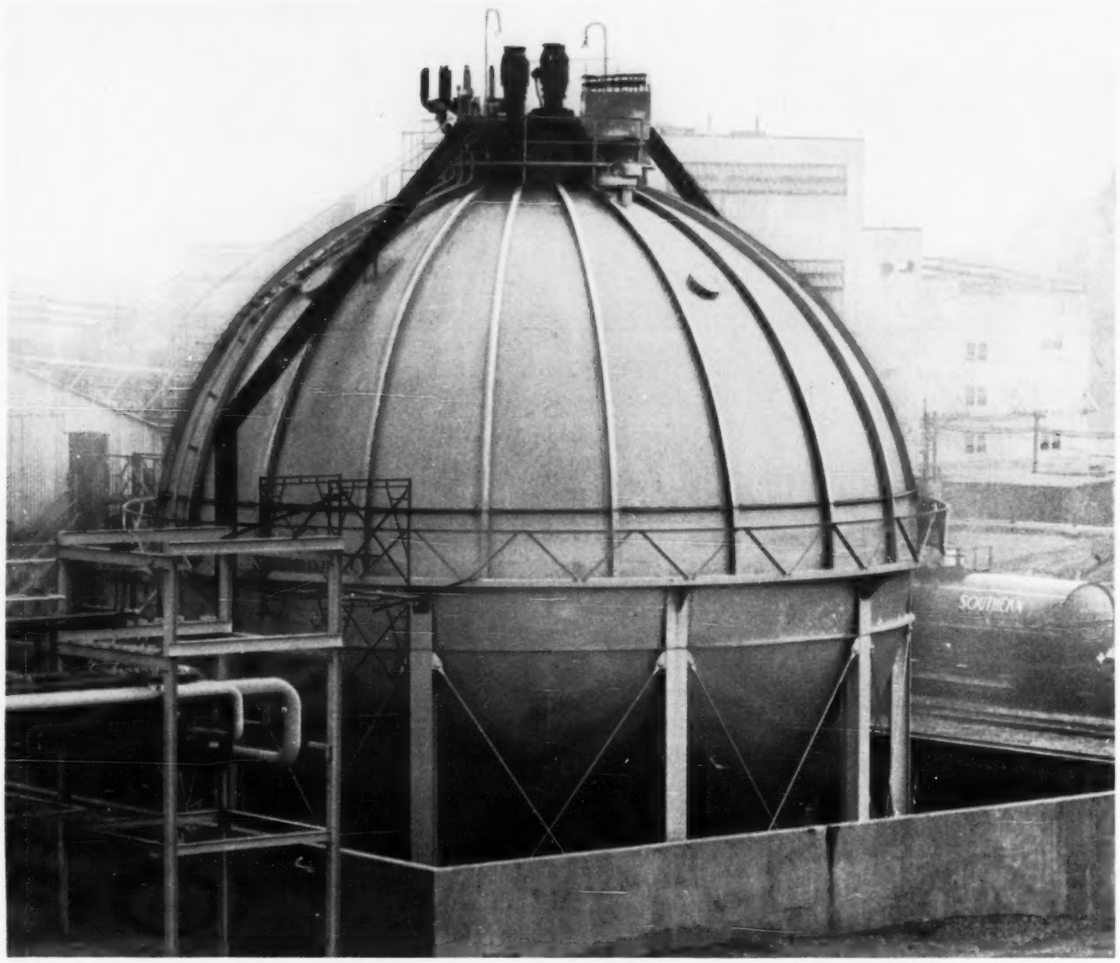


2¼% nickel steel tank stores 2000 tons of liquefied chlorine at −30°F... safely

20-year service record in many installations proves this nickel steel dependable for storage of liquefied gases down to −75°F.

In two decades of service in the recommended temperature range, there has never been a single incident of field failure of any 2¼% nickel steel vessel.

This record alone would be proof enough. But here's more:

- The *only* material approved for ocean shipment of liquefied propane is 2¼% nickel steel. Temperature: −44°F.
- This steel conforms to ASTM Specifications A203 (Grade B) and A300. It readily exceeds the minimum specified impact requirement of 15 ft-lb. keyhole Charpy at −75°F.
- The standard welding and forming operations are performed on 2¼% nickel steel without difficulty.
- The ASME Boiler and Pressure Vessel Code allows design stresses to 17,000 psi using 2¼% nickel steel.

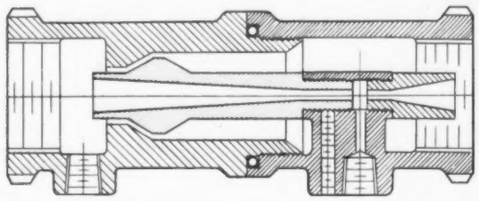
Knowing these facts, it's easy to see why Columbia-Southern approved this material for this 2000-ton-capacity sphere. It bulk-stores chlorine at −30°F and at atmospheric pressure. Now in service 4 years, the tank fulfills every expectation of the fabricator, and of Columbia-Southern Chemical as well.

If you'd like complete data on 2¼% nickel steel, and other nickel alloy steels for service at temperatures as low as −320°F, write for your copy of "Properties of Nickel Steel Plates at Low Temperatures." Just drop a postcard to:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street INCO New York 5, N. Y.

INCO NICKEL
NICKEL MAKES STEEL PERFORM BETTER LONGER
Circle 23 on Reader-Service Card for more information

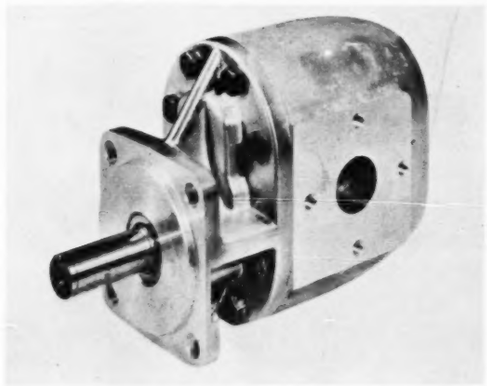
Continuous-Flow Air Charger 306



Operating through the vacuum generated by venturi action, this air charger provides a continuous metering of air or other gases into any pipeline carrying a flow of liquid under pressure. The unit can handle water flow from 360 to 6000 gph at pump pressures varying from 25 to 90 lb. Larger capacity designs are under development.

Nielsen Mfg. Co., P. O. Box 5083, Eastmont Station, Oakland, Calif.

2800 RPM Gear Pumps 307



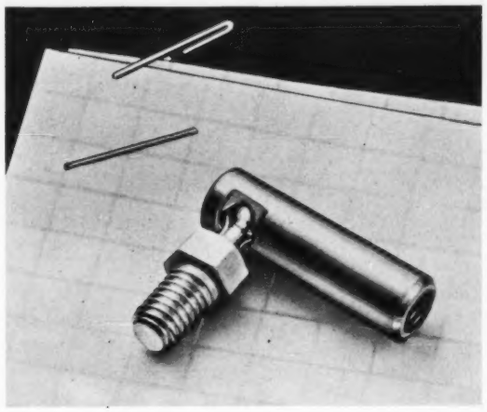
Pressure-balanced gear pumps with speeds to 2800 rpm and flow rates to 60 gpm permit operation at mobile equipment engine speeds. Continuous pressures to 2250 psi are acceptable and operating temperatures may reach 250F with minimum oil viscosity of 55 ssu. Pumps may be coupled to prime mover or driver through belts or gears. The pressure-balanced, self-compensating design employs discharge pressure to maintain an optimum counterbalanced thrust of journal bearings toward gear faces to control leakage and wear. Pressure lubrication independent of discharge pressure provides true journal bearing life.

Berry Hydraulics, Div. of Oliver Tyrone Corp., Corinth, Miss.

Miniaturized Ball Joint 308

The ball screw of this tiny component is 5/8 inch long to center, with 1/4-inch hex wrenching flats and 10-32 thread. Shell of the Type FM is only 27/32 inch long, 1/4 inch in diameter. Female threads in tapped hole of shell run from No. 4 to 10. Assembly is designed to give full freedom of movement to ball with no binding at neck. Entire unit is cadmium plated.

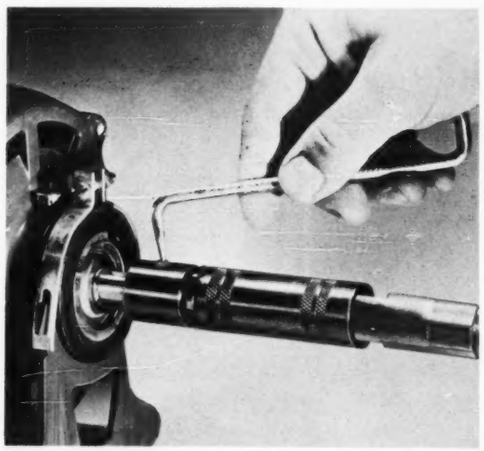
J. J. Tourek Mfg. Co., 1901 S. Kilbourn Ave., Chicago 23, Ill.



Flexible Shafts 309

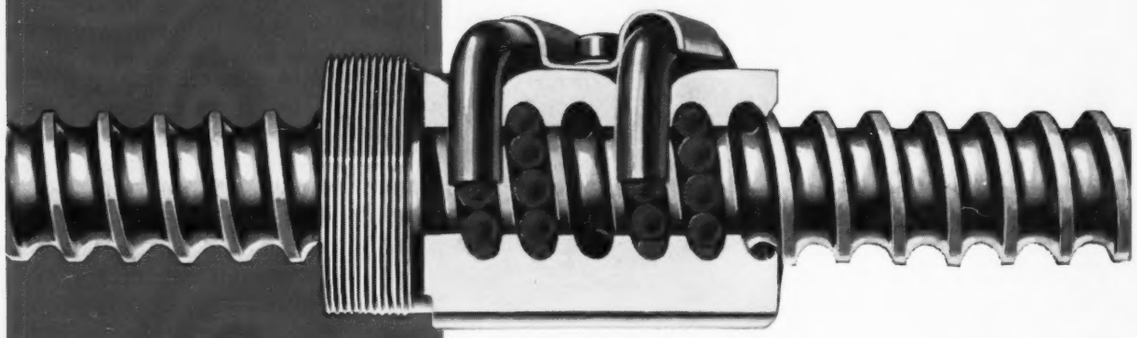
A complete package—shaft, neoprene-covered casing and standardized coupling—is offered in shaft sizes from 0.150 to 0.500 inch. Standard shafts are suitable for prototype or medium-volume requirements, for either power transmission or remote control, and can also be utilized to simplify existing equipment.

S. S. White Industrial Div., 10 E. 40th St., New York 16, N. Y.



MINIATURE Small enough to rest on the head of a tack, the newest and tiniest Saginaw b/b Screw is only 3/4 of an inch long, has a B.C.D. of just 3/16ths of an inch. It solves positioning/control problems in telemetering and guidance systems and other diminutive applications.

GIANT-SIZED Giant Saginaw b/b Screws, built as large as 6 inches B.C.D. and as long as 40 feet, are used in applications where size reaches gigantic proportions. Proof of their versatile adaptability, Saginaw b/b Screws are used in boom hoists, telescoping blimp mooring masts and other applications.



WRITE TODAY FOR Saginaw's new 1961 fact-filled Engineering Data Book.

SAGINAW ball/bearing SCREWS CARRY YOUR PRODUCT'S SUPERIORITY FURTHER!

The men who want to increase their product's maximum potential specify the remarkable Saginaw Screw for its many advantages. The 90%-plus efficiency of actuators using the ball bearing screw principle lowers operating costs, requires far less maintenance, simplifies design, in many instances reduces installation costs. Saginaw Screws are adaptable to electrical, hydraulic, mechanical or pneumatic operation. Their length and ball circle diameters can be built to almost any size. Their dependability and accuracy can improve your product's function and help make it more competitive!

Saginaw ball/bearing Screw

SAGINAW STEERING GEAR DIVISION OF GENERAL MOTORS CORP., SAGINAW, MICH.

Circle 24 on Reader-Service Card for more information

GRIPCO TOPLOCK NUT
One piece all metal.

GRIPCO CLINCH NUT
With or without self-locking threads. Hex collar prevents turning when torqueing bolt.

You get these "extras" when you specify

GRIPCO®

GRIPCO PILOT-PROJECTION WELD NUT
With or without self-locking threads. Centering collar positions nut and protects threads from weld spatter.

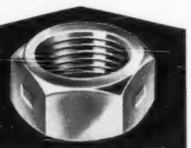
FASTENERS—

Service—40 sales representatives all over the country for prompt, fast service.

Reliability—Quality controlled by the oldest established lock nut manufacturer in the U.S.

Stock—Large inventories to ensure out of stock delivery on all catalogued items.

Speed production and lower costs on your products with this GRIP NUT family of GRIPCO FASTENERS. Qualified fastener engineers are available for consultation on all your assembly problems. Consult the yellow pages in your phone book under "GRIPCO" for the one nearest you.



GRIPCO CENTERLOCK NUT
Locking feature in the center for fast feeding. Can be applied from either end.

Other Gripco Products:

- Brass Toplock or Centerlock nuts.
- Miniature weld and clinch nuts, with or without lock.
- Toplock and Centerlock Hi Nuts.
- Standard Semi-finish full and jam nuts.
- Stainless Steel lock, weld and semi-finish nuts.
- Cold formed special nuts or parts to print.

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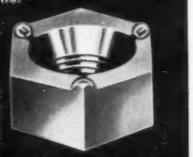


GRIPCO COUNTERSUNK WELD NUT
With or without self-locking threads. Countersink protects threads from weld spatter.

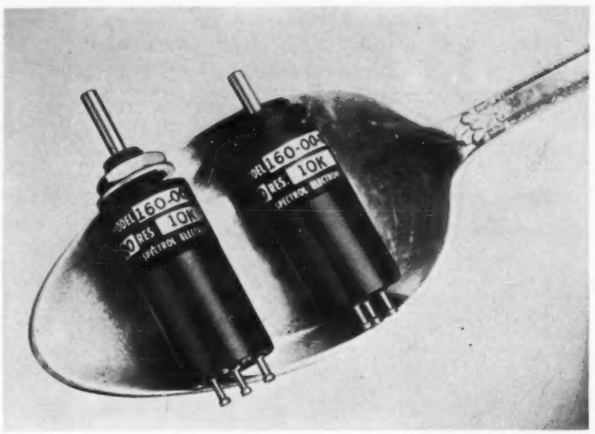
GRIP-NUT COMPANY 125

101 MAPLE AVE.
SOUTH WHITLEY, INDIANA
Phone: South Whitley 723-5111

Subsidiary of Heli-Coil Corporation, Danbury, Conn.

Circle 25 on Reader-Service Card for more information

Miniature 10-Turn Potentiometer 310



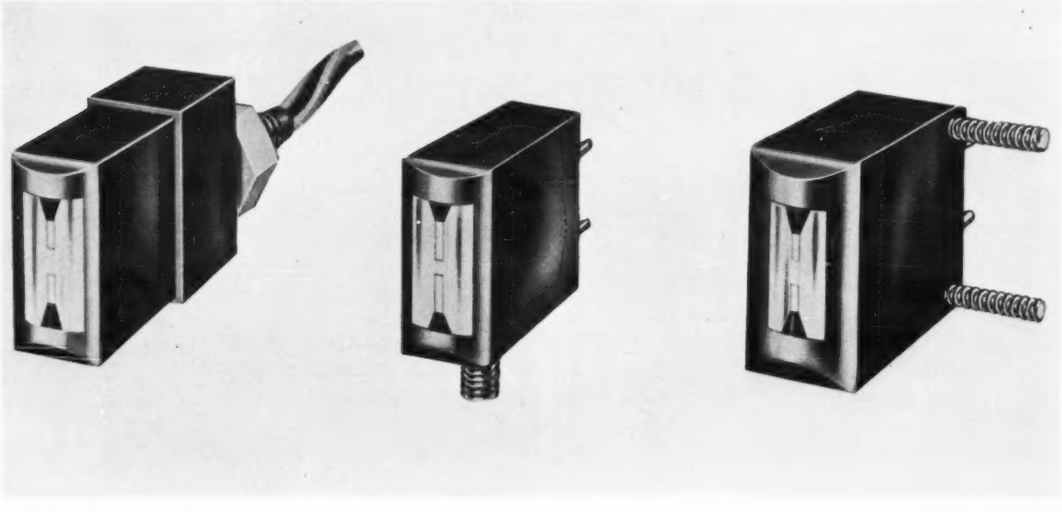
A ½-inch dia precision potentiometer offers resistances to 200k ohms with a standard linearity tolerance of ±0.5 percent. Designated model 160 and housed in anodized aluminum, the device can be furnished with a special linearity tolerance to ±0.05 percent. Terminals are mounted on rear housing lid and protrude from the end, providing a true ½-inch dia pot without projections. This pot would actually fit inside a ½-inch cylinder. All tap terminations are welded rather than soldered and mechanical stops will withstand a 20 oz-in force. Key specifications are: standard resistance range, 50 to 200k ohms ±5 percent; operating temperature range, —55 to 125C; power rating (40C ambient), 2.5w; voltage breakdown, 500v rms; maximum starting torque, 0.75 oz-in; running torque, 0.5 oz-in (bushing mount); insulation resistance, 100 megohm minimum at 500v d-c.

Spectrol Electronics Corp., 1704 S. Del Mar Ave., San Gabriel, Calif.

Tape Recorder Erase Heads 311

Stereo and monophonic erase heads for use with two-track (half-track) and four-track (quarter-track) magnetic tape are available in three basic mounting styles. Double-gap construction is employed for clean quiet erasure with a minimum power requirement. Tape comes into contact with only the polished metal face, giving long life, low tape friction and freedom from oxide loading. Heads are offered in two impedances: No. 1 high-impedance head requires approximately 115v at 60 kc; No. 4 low-impedance operates with 35v at 60 kc. Other types are available in production quantities.

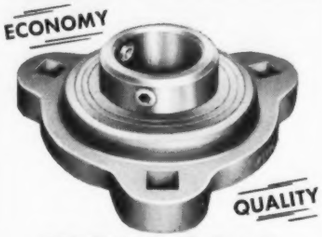
Nortronics Co., Inc., 1015 S. 6th St., Minneapolis 4, Minn.



NEW *from*

SEALMASTER®

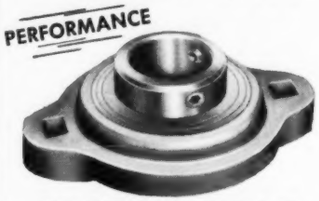
ECONOMY



QUALITY

"LF" 3-BOLT FLANGE UNIT

PERFORMANCE



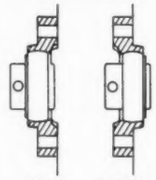
"LFT" 2-BOLT FLANGE UNIT

AVAILABLE IN A COMPLETE LINE

•

SHAFT SIZES 3/4" thru 17/16"

REVERSIBLE FOR FLUSH OR RECESSED MOUNTING



FLUSH MOUNTING RECESSED MOUNTING

- Precision self-aligning one-piece unit. No extra assembly costs.
- Malleable housing provides maximum strength with light weight.
- Permanently sealed—prelubricated with high grade lubricant.
- Nothing of comparable value in low price field.
- Reversible for flush or recessed mounting.

WRITE FOR CATALOG 359

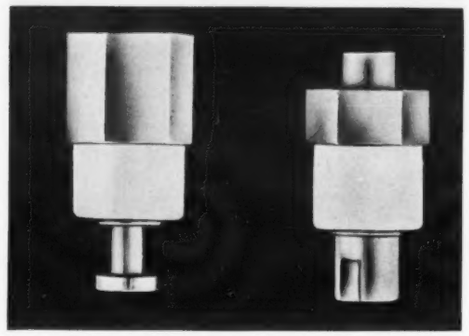
SEALMASTER

BALL BEARING UNITS

SEALMASTER BEARINGS
A DIVISION OF
STEPHENS-ADAMSON MFG. CO.
29 RIDGEWAY • AURORA, ILL.
PLANTS LOCATED IN: LOS ANGELES, CALIF. CLARKSDALE, MISS. • BELLEVILLE, ONTARIO

Circle 26 on Reader-Service Card

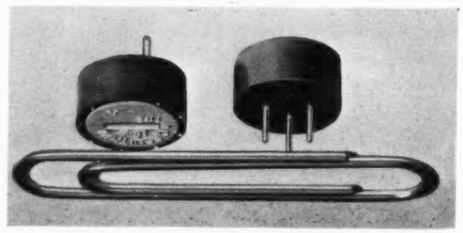
Stand-Off Insulators 312



The body material of these electronic components is fabricated of "Teflon". Turrets are machined from brass rod, with hot-tin dip finish to enable easy soldering. (Other finishes are available on order.) Bases are hex brass, cadmium plated and dipped in olive-drab iridite to comply with military requirements. Stand-off insulators are supplied as insulated tie-points in circuit wiring, offering low-loss, high-frequency service in radar, television and other electronic equipment. They are unaffected by humidity, mechanical shock and vibration, and are designed for ambient temperatures from —110 to 500F, pressure altitudes from 0 to 80,000 ft.

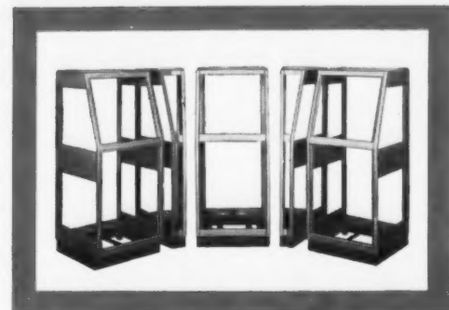
Garlock Electronic Products, Garlock, Inc., Camden 1, N. J.

Subminiature Trimming Potentiometers 313



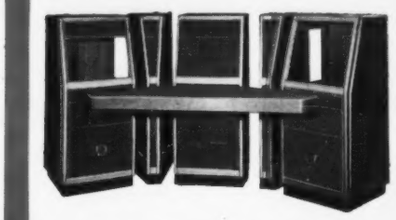
Precision trimmers, for printed-circuit and other high-stability applications, offer economy as well as good mechanical and electrical characteristics. Electrical and mechanical rotation are 320 deg ±5 deg. Type CT-200 is a ½ by ½-inch square precision unit for stability under extreme conditions and is available with printed-circuit terminals or "Teflon"-coated wire leads. Standard resistance range is 10 to 50k ohms and standard resistance tolerance is ±5 percent. Power rating is 1.0w at 60C. Operating temperature range is —55 to 150C for 225C.

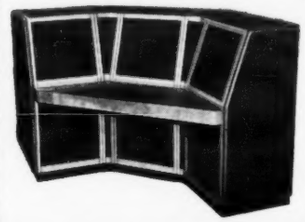
International Resistance Co., 401 N. Broad St., Philadelphia 8, Pa.



CONTROL CENTER ASSEMBLY

FEATURES ERECTOR SET SIMPLICITY WITH . . .





EMCOR® STANDARD CABINETS

The ultimate in packaging flexibility is available to help reduce costly design time and custom housing modification. The photographs above graphically illustrate the ERECTOR SET SIMPLICITY in assembly attained through the use of EMCOR Standard Cabinets. Speed of assembly is only one advantage attained with EMCOR Enclosures. Choose from over 600 basic frames plus thousands of components and associated equipment of the EMCOR MODULAR ENCLOSURE SYSTEM. Discover for yourself, the compatibility which can be attained by using any combination of frames and components, the lasting and aesthetic beauty of cabinet design and appearance plus the proven structural capabilities of the EMCOR Fine Line of Quality. Contact your local EMCOR Sales Engineering Representative or write for full details today.

QUALITY EMCOR PRODUCTS

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Originators of the Modular Enclosure System

Ingersoll PRODUCTS DIVISION
BORG-WARNER CORPORATION
630 Congdon Avenue Dept. 1239 Elgin, Illinois

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a positive seal on glass tubing
with a complete line of tube connections for laboratory work, vacuum systems and general usage. Whether your problem is connecting glass to glass, glass to metal or glass to plastic . . . any installation requiring an absolute seal on glass, plastic or metal tubing—
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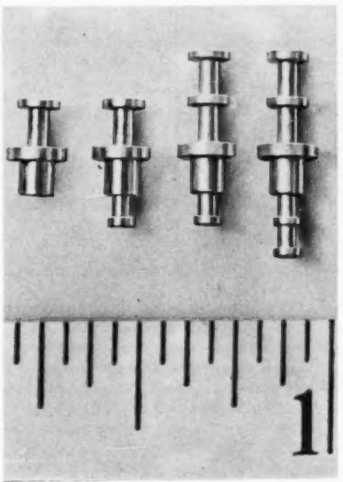
CRAWFORD FITTINGS (CANADA) LTD.
NIAGARA FALLS, ONTARIO, CANADA

Feed-Through Terminals 314

Stand-off and feed-through terminals are designed to withstand heavy wiring in production and prototype work. No. 1040 is a single-turreted stand-off terminal. Height, when mounted, is 0.159 inch. 1041 is a feed-through with a single turret at each end. Height, when mounted, on one end is 0.159 inch and on the other end approximately 0.082 inch. Feed-through terminal No. 1042 has a double turret at one end and a single turret at the other. Height of double-turreted unit, when mounted, is 0.281 inch and single-turreted terminal is approximately 0.082 inch. Feed-through No. 1043 has a mounted height of 0.181 inch at one end and 0.164 inch on the other. All four terminals have shank diameters of 0.090 inch. Terminals are brass per QQ-B-626a, Comp. 22½ hard, and finished in 0.003-inch silver plate plus water-dip lacquer.



Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

Circle 28 on Reader-Service Card

Rechargeable Battery 315

A hermetically-sealed cell of 4 amp-hr capacity is adaptable to large current requirements and where space and weight are a premium. Rechargeable cell is a 1.25v standard "D" size unit which can be discharged at loads up to 50 amps and will supply hundreds of cycles of charge and discharge. "Nicad" cells may be trickle-charged to maintain full charge indefinitely. When connected in series, they form batteries of standard voltages.

Gould-National Batteries, Inc., St. Paul 1, Minn.

Power Control Relays 316

PC and PG series relays are available in a-c and d-c with a 15-amp resistive, 5-amp inductive current rating and a range of coil voltages, mounting and terminal arrangements. Series PG is also manufactured hermetically sealed and with double-break contacts rated at 20 amps resistive. Contact arrangements are SPDT to 4PDT for PC series, and SPDT, DPDT for the PG series.

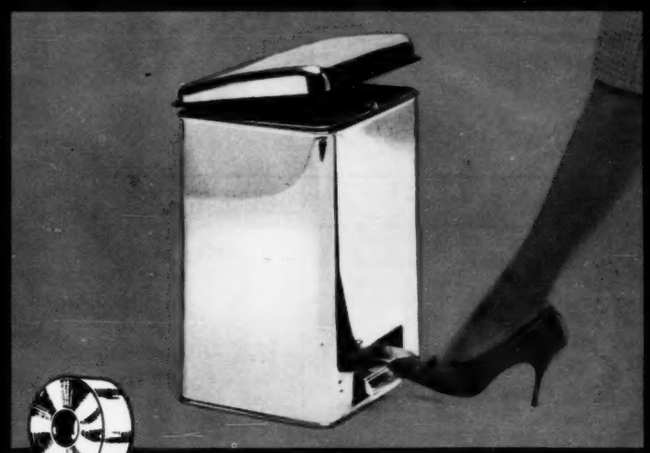
Elgin Advance Relays, Electronics Div., Elgin National Watch Co., 2435 N. Naomi St., Burbank, Calif.

Circle 29 on Reader-Service Card

NICKELOID IS EVERYWHERE

IN MOST ANY ROOM

IN THE GAME ROOM



IN THE KITCHEN

These eye-catching products use functionally a basic Nickeloid Metal. The finish of Chromium, Nickel, Brass or Copper is electroplated to a base metal, usually Steel (but often Zinc, Brass or Copper).

Mostly, Nickeloid Metals are supplied in continuous coils in widths up to 24" for modern, low cost fabrication. They're also available in sheets and strips. Optional: bright or satin finishes, plating one or both sides, a galaxy of stunning patterns and crimps.

Quality plating produces metals so durable they can be fabricated, even quite severely drawn or bent. Rejects minimized. For severe stamping, we offer Mar-Not protective coating that is easily peeled off after its job is done.

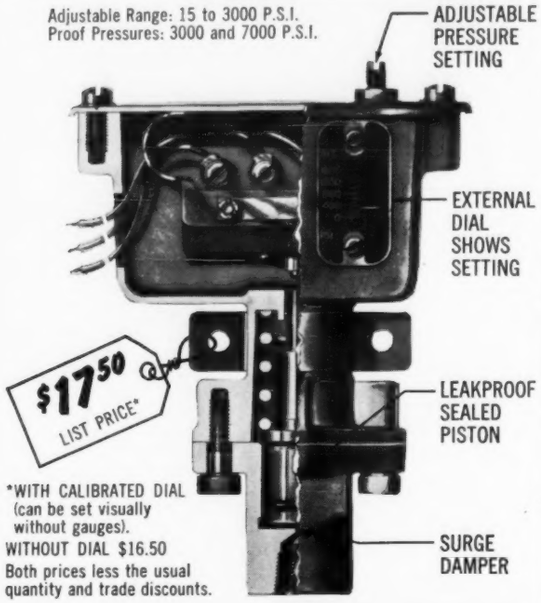
These handsome articles of daily use are striking indeed! Not a little of this is achieved by the functional use of bright plated Nickeloid Metals in Chrome, Brass or Copper finishes. But look again! These pictures carry a deeper, even more dramatic story . . . the story of a *new concept* of manufacture. Not always do artisans work with raw steel sheet. Not always is the final finish applied by the extra step of painting or plating. With Nickeloid Metals this finish is built-in, and it's done by a company which has dedicated itself to electroplating of sheets and coils for industry for over 60 years! The use of Nickeloid Metals as a pre-finished raw material proves the theorem that a straight line is the shortest distance between two points. Write for free Introductory Kit that unfolds the entire story and provides you with metal samples. Or, phone a Nickeloid sales office in one of the principal cities.

AMERICAN NICKELOID COMPANY · PERU 9, ILLINOIS

America's Pioneer Manufacturer of Pre-Finished Metals—Since 1898

ONLY
This Pressure Switch
Resists 7000 p.s.i. Surges
and Stays Accurate within 2%

Adjustable Range: 15 to 3000 P.S.I.
Proof Pressures: 3000 and 7000 P.S.I.



*WITH CALIBRATED DIAL (can be set visually without gauges).
WITHOUT DIAL $16.50
Both prices less the usual quantity and trade discounts.

WE BUILD IN	WE DON'T USE
RUGGEDNESS CAN TAKE SURGES (High proof pressures) CONTINUOUS OPERATION (Millions of cycles) NO STICKING (in dirty fluid)	LINKAGES & BEARINGS WHICH WEAR QUICKLY (cause settings to drift and switch to fail).
LABOR & MATERIAL SAVINGS NO RETURN DRAIN PIPING (Sealed piston) MOUNTS WHERE CONVENIENT (Operates in any position, not sensitive to vibration)	UNSEALED PISTONS WHICH ADD TO YOUR INSTALLATION COST (return piping). ARE CRITICAL TO DIRT (pistons get stuck).

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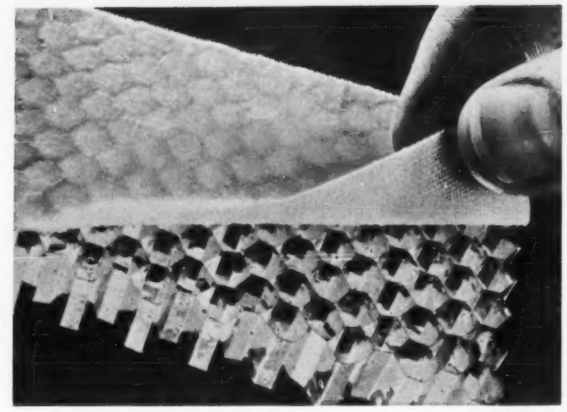
5125 Alcoa Avenue, Los Angeles 58, California
Circle 30 on Reader-Service Card for more information



Epoxy Film Adhesive 317

A high-strength supported epoxy resin film adhesive combines advantages of film adhesives with good self-filleting properties of epoxy adhesives. Designated "Scotch-Weld AF-106", it offers many design and cost-saving advantages for economical bonding of metal and paper honeycomb cores to metal facings in honeycomb sandwich construction. Adhesive provides metal-to-metal bonds, with shear strengths of over 2000 psi at 75F, maintains high strength over a service temperature range of —67 to 300F, and has high peel strength. It has high creep resistance under constant stress, good adhesion to metals and plastics, and high resistance to water, 20-percent salt spray, hydraulic oil and aromatic fuel. Maximum strength is obtained with an optimum cure of 1 hr at 350F under 25 to 50 psi. High bond strength can be obtained with a cure time as low as 2 to 3 minutes at temperatures in the 400 to 450F range.

Minnesota Mining & Mfg. Co., Adhesives, Coatings & Sealers Div., 900 Bush Ave., St. Paul 6, Minn.

Gasket Compound 318

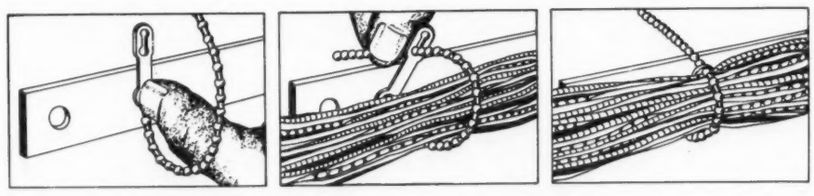
An easy-to-apply gasket compound is available for leakproofing gasketed assemblies. It also can be effectively used to repair broken gaskets, for building up damaged, misaligned or warped flanged surfaces, or as a gasket substitute where surfaces permit. The material can be used for a variety of industrial fluids and gas services including water, steam, oil or water-based hydraulic fluids, LP and natural gases, petroleum products, mild corrosives and many chemicals. Temperature range is from —65 to 400F, pressures to 5000 psi. It is available in two types: a soft-set variety for connections that must be periodically disassembled, and a hard-set variety for permanent installations. Both types are available in 1½, 3 and 11-oz tubes.

Crane Packing Co., Dept. DN-1, 6400 Oakton St., Morton Grove, Ill.

Plastic Cable Tie 319

A combination wire tie and cable clamp cuts material costs and speeds assembly by eliminating separate cable clamps, mounting screws and wire ties in many applications. A push-button snaps into any 0.250 to 0.265-inch diameter hole, securing tie to chassis or frame. The tie, "E-Z Wire Tie", adjusts to 30 different sizes from ⅛ to 1-5/16-inch diameter and can be opened and closed to add or repair wires without removing "push-button" mounting. These tie-clamps are made from high-dielectric polyethylene. They are chemically inert and heat resistant, and can be obtained in three different colors, 5½ inches long. Free samples are available.

Richco Plastic Co., 3722 W. North Ave., Chicago 47, Ill.

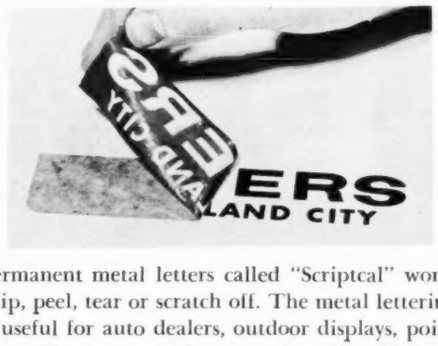


'Self-Activating' Epoxy Stripper 320

Epoxy and polyester-based coatings can now be removed easily with a gelatinous self-activating stripping agent. "Tele-Solv G" is useful for removing commercial paints, or resin-based coatings and materials from large-area surfaces when the part cannot be immersed in a liquid stripping agent. When part is stripped to requirements, residue is easily removed. Parts or surfaces can be worked on immediately without cleaning or further treating following removal of stripping agent. It will not corrode, discolor or damage copper, aluminum or ferrous metals. No special equipment or mixing is required for the non-flammable and non-acidic material.

Narmco Industries, Inc., 600 Victoria St., Costa Mesa, Calif.

Pressure-Sensitive Metal Letters 321



Permanent metal letters called "Scriptcal" won't chip, peel, tear or scratch off. The metal lettering is useful for auto dealers, outdoor displays, point of purchase, gas stations, product identification and hundreds of additional uses. Made of anodized aluminum that is light, bright, colorful and rugged, the material presents a floating effect with no background metal. It can be adapted to fit any design or letter styling.

Ever Ready Label Corp., 357 Cortlandt St., Belleville 9, N. J.

Solder Foil 322

Soft solder foil in a wide range of alloys, melting points and sizes includes over 50 different alloys with melting points that vary from 100 up to 400C. The foil is obtainable in widths up to 6.00 inches maximum and in thicknesses down to 0.0005 inch, with tolerances held as close as ±0.0001 inch.

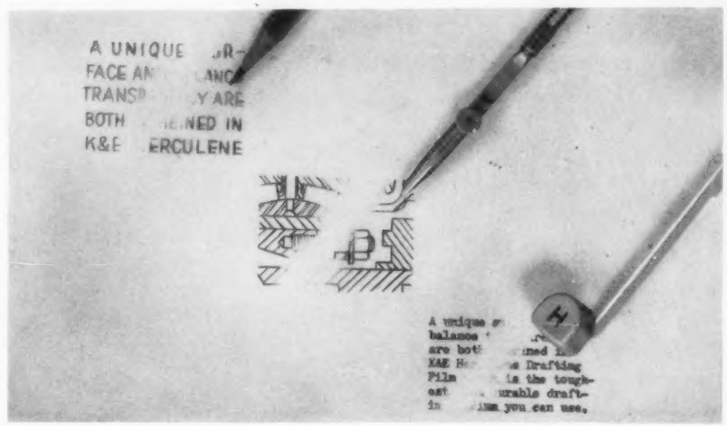
Accurate Specialties Co., Inc., 340 Hudson St., Hackensack, N. J.

Some Ideas

K+E

for your file of practical information on drafting and reproduction from

KEUFFEL & ESSER CO.



Six years ago, K&E introduced the very first polyester-base drafting film—a special-purpose medium featuring extreme dimensional stability. Experience with that film indicated that a definite need also existed for a *general-purpose* drafting film, if one could be perfected. About two and a half years ago we succeeded, introducing HERCULENE® Drafting Film – the first polyester-base medium for general drafting to meet professional standards. Many recognized its value immediately, stocked up on HERCULENE, and have used it happily ever since. Others – a bit more "canny" about adopting a relatively untried medium – deferred decision, saying "see us in a year or so." Still others – having tried one or more of the other films marketed immediately after HERCULENE – seemed permanently disenchanted with *all* film based media. What with the passage of time and much favorable ado about drafting films in general, we rather think that those once stung may now have adopted a more congenial attitude – so we address ourselves solely:

To fence-sitters everywhere . . .

Just as we felt in '58, we feel today, that film has an important place in the drafting room. The only difference now is that experience has *proved* it so. Since 1958, the number of HERCULENE users has grown by leaps and bounds. All, we're happy to say, have found HERCULENE a welcome, efficient, and *much needed* addition to their stock of drafting media. It is these HERCULENE users who have written the record. Their many and rigorous tests, their months of experience, their numerous successes and continuing satisfaction are convincing evidence that HERCULENE is all we said it would be.

Why all the fuss about HERCULENE? . . .

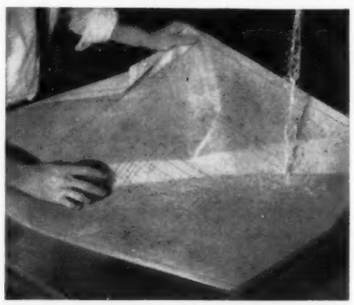
HERCULENE combines practically all the qualities of a perfect drafting medium. An excellent product when introduced, it's even closer to perfection today. Working with major film users, K&E specialists have refined HERCULENE in many subtle ways since its introduction.

Unlike cloth or paper, HERCULENE is virtually indestructible. No matter how roughly or frequently a HERCULENE tracing is handled, it will never crack, wrinkle or fade. Absolutely waterproof, a HERCULENE drawing can never be permeated and ruined by moisture. Filed away, HERCULENE will last indefinitely. And HERCULENE has body, too, making it far easier to handle and file, and to keep flat on the drawing board.

Most of the refinements made in HERCULENE since 1958 have concerned its engineered drafting surface. HERCULENE's surface "take" for pencil, ink and typing is now better than ever. Erasability, of course, is excellent for all three. Contrast has been built up for sharper definition of line, too, yet all the transparency necessary for fast, clear reproductions has been maintained.

Two big bonuses, too . . .

A significant chapter in the HERCULENE story has been the development of a waterproof writing mate – the Duralar plastic pencil. Drawings made on HERCULENE with this waterproof pencil can actually be



washed in soap and water. Even gray, grimy "unreproducible" drawings can be washed spotless with this new technique. Many firms now use the HERCULENE/Duralar team exclusively . . . and are realizing undreamt-of savings in costly re-draws.

Some firms, of course, by virtue of smaller work volumes and "cleaner" or less frequent handling, will have little need for this new wash technique. Of particular interest here is another K&E exclusive recently introduced – the amazing Ruwe pencil. The Ruwe pencil will not withstand washing, but in every other respect, this new pencil is graphite-*plus*. Although of plastic composition, the Ruwe pencil has all the "fine" feel of graphite, erases well, and deposits a sharp, dense black line. The big bonus: Ruwe pencil lines are *virtually smudge-proof*. Rendered on HERCULENE's engineered drafting surface, they actually resist smudging better than graphite on regular paper!

We leave it to you . . .

The best test remains the one you make for yourself. We've just completed a new brochure, titled "A Report on the Growing Acceptance of Polyester Film." In it is detailed most of what we have learned about HERCULENE and its use since 1958 – including tests you can make to assess its every property. We'd like you to have a copy of this new brochure – plus a sample sheet of HERCULENE, a Duralar pencil, and a Ruwe pencil – for your own private testing. To get these free samples, simply fill out and mail the coupon below:

KEUFFEL & ESSER CO., Dept. DN-1 Hoboken, N. J.

Gentlemen:

Please send me your new brochure, titled "A Report on the Growing Acceptance of Polyester Film," a sample sheet of HERCULENE Drafting Film, and samples of the Ruwe and Duralar Pencils.

Name & Title _____

Company & Address _____

4031

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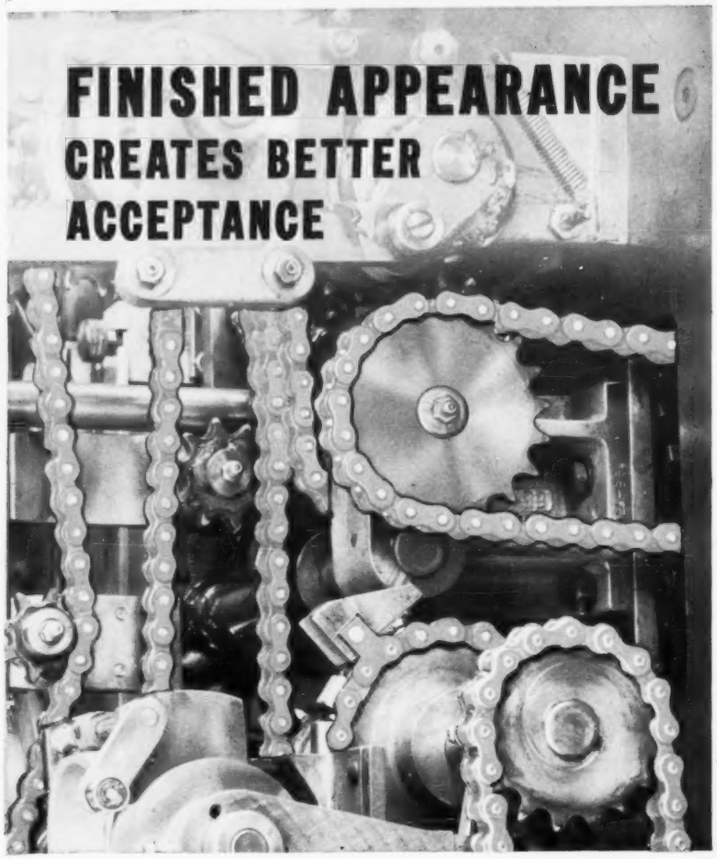


Acme Chains are chemically processed in special electronic furnaces to produce a distinctive chemically blued steel, on the side plates of all chains, for better appearance. This process — originated by Acme's Engineers — give the precision made chains a much better appearance.

The gleaming blue lustre of these chains when used on machinery — as shown in above photo — greatly enhance their appearance and sales value.

All Acme Chains are built in conformity with A. S. A. standards and are available from ¼" pitch to 2½" pitch.

Your local distributor carries a full line of Acme Roller Chains and is well qualified to help you in selecting the right chain for the right purpose. Call him for prompt service.

Acme Chain Corporation
HOLYOKE MASSACHUSETTS

Write Dept. 14-U for new ill. 100 page catalog with engineering section.

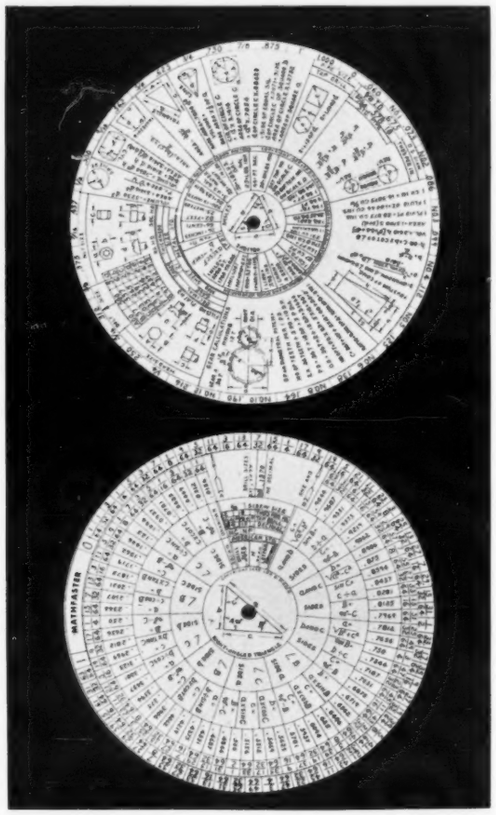
RELIABLE CHAIN DRIVES FOR ALL INDUSTRIES

ROLLER CHAINS, SPROCKETS, CONVEYOR CHAINS, FLEXIBLE COUPLINGS, ATTACHMENTS. (Special and Standard)

Circle 32 on Reader-Service Card for more information

Mechanical Calculator 323

Eliminating the need for reference to wall charts, handbooks and data sheets, the "Mathfaster" permits rapid addition or subtraction of fractions and provides immediate access to such information as: decimal equivalents of fractions; illustrated dimensions of round, flat, socket or fillister-head screws and nuts; tap drills and threads per



inch of NC and NF screws; decimal size of both letter and number drills; easily-understood diagrammed formulas for solutions to triangles and areas or volume of basic forms such as circles, trapezoids and cones; easy-to-compute gear and pulley calculations; gage number and thickness of standard sheet-metal sizes; and frequently-used slide-rule conversion factors.

Pierce Mathfaster Calculator, Box 837, Arleta, Calif.

INTEGRALLY BUILT-IN GEROTOR PUMPS IDEAL FOR HYDRAULIC SERVOS

► Important advantages are offered by the Gerotor pump for servo control applications. It is a positive displacement pump and provides a smooth power flow from one end of the pumping cycle to the other. Unlike other types of pumps which tend to quit work at the low end of the speed range, *Gerotors stay right on the job and provide positive power to the extremely low range.* Thus, they are exceptionally responsive in servo systems.

► **Now the development of three matched pumping elements permits designers to build-in a Gerotor pump as an integral part of any hydraulic mechanism or system.**

► Consisting of an inner and outer Gerotor and an eccentric-locator ring, the unit becomes a complete pump by simply boring the casting or frame of the mechanism to accommodate the locator ring O.D. and by providing porting. This design makes the main casting do double duty as the pump housing, thus eliminating a very considerable cost factor. A drive can be taken from any convenient shaft. Obviously, such a built-in pump costs far less than complete pumps purchased outside. This results from the elimination of mounting pads, couplings, lines, connections and accessory drives.

Fig. 1. Three Gerotor components permit pump to be incorporated as integral part of housing or frame of mechanism, eliminate need for purchase and mounting of separate, complete pump.

► **The matched elements are thus as easily built in as a simple anti-friction bearing would be. Further, the Gerotor pump is extremely flexible in its configuration and readily adapts to a wide variety of mechanism geometries. It will handle a variety of fluids at rates up to 100 gpm and pressures up to 1,000 psi. A simple, positive-acting automatic reversing feature can be built in at little cost.**

► Typical examples of servo applications include ship anti-roll stabilizer control, steering mechanisms, and hydraulic piston positioning and actuation in a wide variety of industrial applications.

► *Technical data is available and your inquiry is invited. Write:*

W. H. NICHOLS CO.

Makers of Zenith Metering Pumps and the Nichols Milling Machine "the miller that uses its head".

48 WOERD AVE., WALTHAM 54, MASS.

Circle 33 on Reader-Service Card

Taper-Pin Insertion Tool 324

Removal and insertion of taper pins in initial assembly and rework is provided with the model 83 insertion tool. A grip-lock head holds pin firmly during insertion or removal. A "non-polarity sensitive" head may be used to grasp taper pin from any direction. Other features include a head which may be used to grasp taper pin over a plastic "spaghetti" covering, both during insertion and removal; a snap-action drive mechanism which provides proper force necessary for pin insertion; and a streamlined head which permits a pin to be grasped when clustered in a tight configuration on connector.

Navigation Computer Corp., 1621 Snyder Ave., Philadelphia 45, Pa.

75W Stereo Amplifier 325

Delivering a conservatively rated output of 37.5w per channel, the Knight KN-755 has a minimum IHFM music power rating of 96w. Four EL34 audio output tubes provide good linear operation. Features include: provision for an optional center-channel speaker for a third (mixed) channel of sound without need for an amplifier; dual phasing switches which permit phase matching of all three speakers for bass reproduction and stereo. A jack on front panel automatically silences speakers when headphones are plugged in. An electronic "safety-gate" circuit reduces headphone volume, regardless of amplifier setting, to prevent blasting of sound or damage to headphones. Frequency response is ±0.5 db, 25 to 20,000 cps. IHFM power bandwidth is 15 to 85,000 cps. Harmonic distortion is less than 0.5 percent at full rated output; IM distortion is less than 2 percent at 37.5w per channel. Hum and noise are 83 db below full rated output for tuner and auxiliary inputs, −63 db for ceramic and magnetic phono inputs and −54 db for tape head input. Output impedances are 4, 8 and 16 ohms for each channel, plus 16-ohm center channel output.

Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill.

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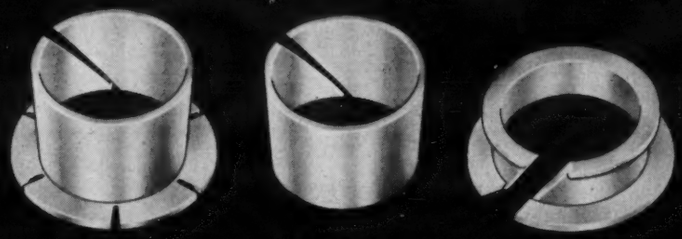
LONG LIFE, *THOMSON* "Snap-In"

NYLINERS®

–*BEARINGS of smooth, tough DuPont* NYLON



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& ELIMINATE LUBRICATION

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- SILENT OPERATION
- LIGHTEST WEIGHT
- REDUCED WEAR

Engineered to Solve Problems . . . Improve Products . . . Reduce Costs!

NYLINER Bearings are a highly engineered thin liner of DuPont Nylon, designed to bring bearing users the many benefits of Nylon as a bearing material by solving most of the limitations surrounding its use. The compensation gap principle assures maintenance of diametral tolerances for precision applications.

Seven Standard Types available from stock. Write for literature and name of your local representative who stocks NYLINER Bearings for immediate shipment.

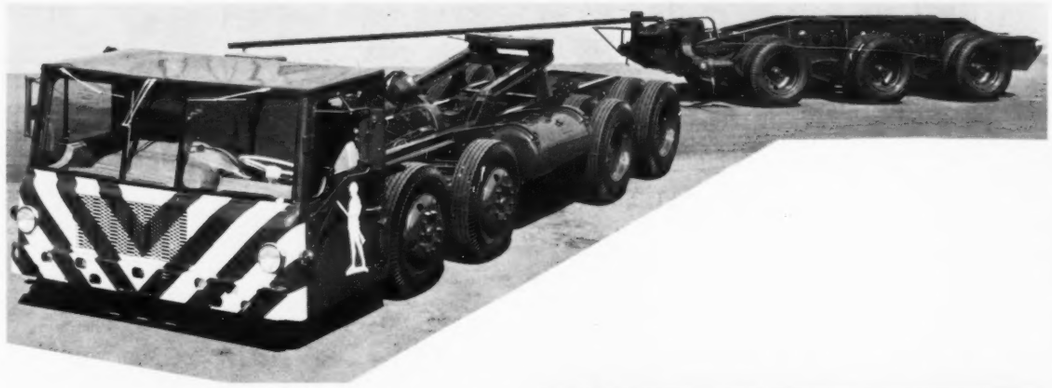
THOMSON INDUSTRIES, Inc.

DEPT. 2, MANHASSET, NEW YORK

Also— –Manufacturers of BALL BUSHINGS . . . the Ball Bearing for Linear Motions and 60 CASE . . . Hardened & Ground Steel Shafting

Light Metals Plus Careful Stress Analysis Reduce Weight of Missile Transporter

Robert L. Candlish, Detroit Editor



GROSS COMBINED VEHICLE WEIGHT of loaded unit exceeds 100,000 lb. Axle loading is limited to 18,000 lb. Missile container projects over low-silhouette cab to reduce load length and increase vehicle maneuverability. Power from 275-hp, twin-6 gasoline engine is supplied to two rear tractor axles. Transmissions are 5-speed main plus 3-speed auxiliary. Air-suspension system protects sensitive equipment in missile. All suspension air bellows on each side of units are interconnected with air lines to form combined unit to reduce over-loading of any one axle. Central driver-controlled heating and air-conditioning system controls temperature of missile container and cab.

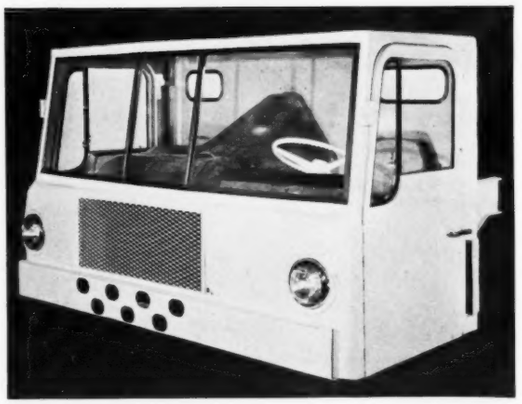
A prime requirement in missile transporter design is light weight so the loaded unit may be driven over standard highway bridges and so the unloaded transporter may be carried by airplane. For this reason, a very large portion of the transporter structure has been fabricated of light metal. When the use of steel was demanded, the use was controlled by a very careful stress analysis and subsequently checked in the final design in assembled form by experimental techniques. The use of light metals plus careful design techniques resulted in curb weights of the tractor and trailer of approximately 13,750 lb and 7,600 lb, respectively.

Aluminum is used in the powertrain, the radiator (61.3 lb), the engine mounts, all engine mounting brackets, the flywheel housing, and the main and auxiliary transmission cases.

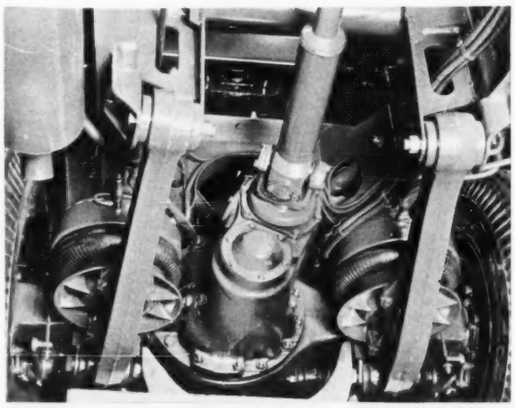
On the chassis, aluminum is used for major components as illustrated plus a number of components such as air tanks, fuel tanks and hangers.

Wheels (22.5 x 7.5 weighing 47.5 lb each) are forged, pre-stressed, heat-treated aluminum disc type with drop-center rim, one-piece construction for use with tubeless tires. Tires are heavy-service highway nylon-cord light-weight 12-ply tubeless type.

The power unit and carriage was developed by GMC Truck and Coach Div., Pontiac, Mich., under sub-contract to the Boeing Airplane Co., Seattle, Washington.



TRANSPORTER CAB is fabricated of magnesium paneling riveted to magnesium structure. Closed-cell vinyl material approximately ⅜ inch thick is bonded to cab interior and motor housing and serves as interior trim, insulation for sound deadening. Material is scuff-proof and is used as floor covering. Lightweight seats are the same aircraft-type used in B-52 jet bomber. Total weight of magnesium cab assembly is 497 lb complete with seats and trim but less operator controls.



RADIUS ARMS for air suspension system are aluminum forgings operating on rubber bushings. All arms are interchangeable. Drive axles are single-reduction full-floating hypoid through-drive type. Axle housing and brackets are SAE-950 steel. Differential carrier and wheel hubs are cast aluminum-alloy 356-T-71.

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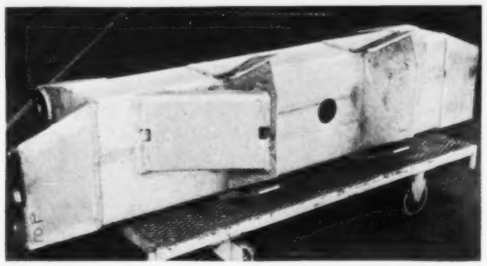
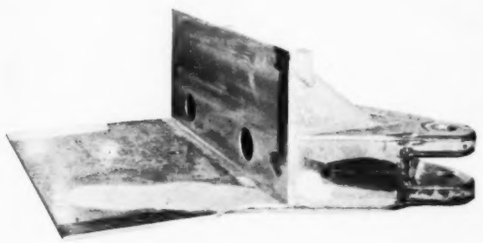
LIGHTWEIGHT FRAMES (SAE 950 steel) are ladder type with fabricated I-beam side members which vary in depth along their length as frame loading varies. (Trailer frame weighs 1460 lb.)

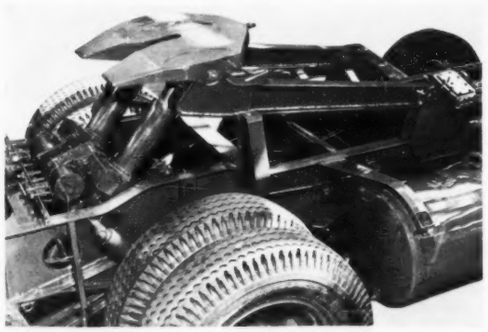


REAR CROSS MEMBER (265 lb) of welded construction 6061-T6 aluminum, stress-relieved and machined, is bolted to trailer frame. Steel pins shrink-fitted in outer ends hold container hinges. Front cross member (210 lb) is constructed similarly but is heat treated.



HINGE ARM ASSEMBLIES are welded-aluminum, heat-treated and machined, and are dye-checked for defects. Weight of finished hinge is 137.0 lb.

FIFTH WHEEL has 10-inch height adjustment. Missile container may be lowered to clear overpasses. Air suspension on trailer and on tractor rear axles may be collapsed and fifth wheel lowered when overhead clearance is limited. Fifth wheel aluminum support frame (75.0 lb) is supported on two hinge-pad brackets.



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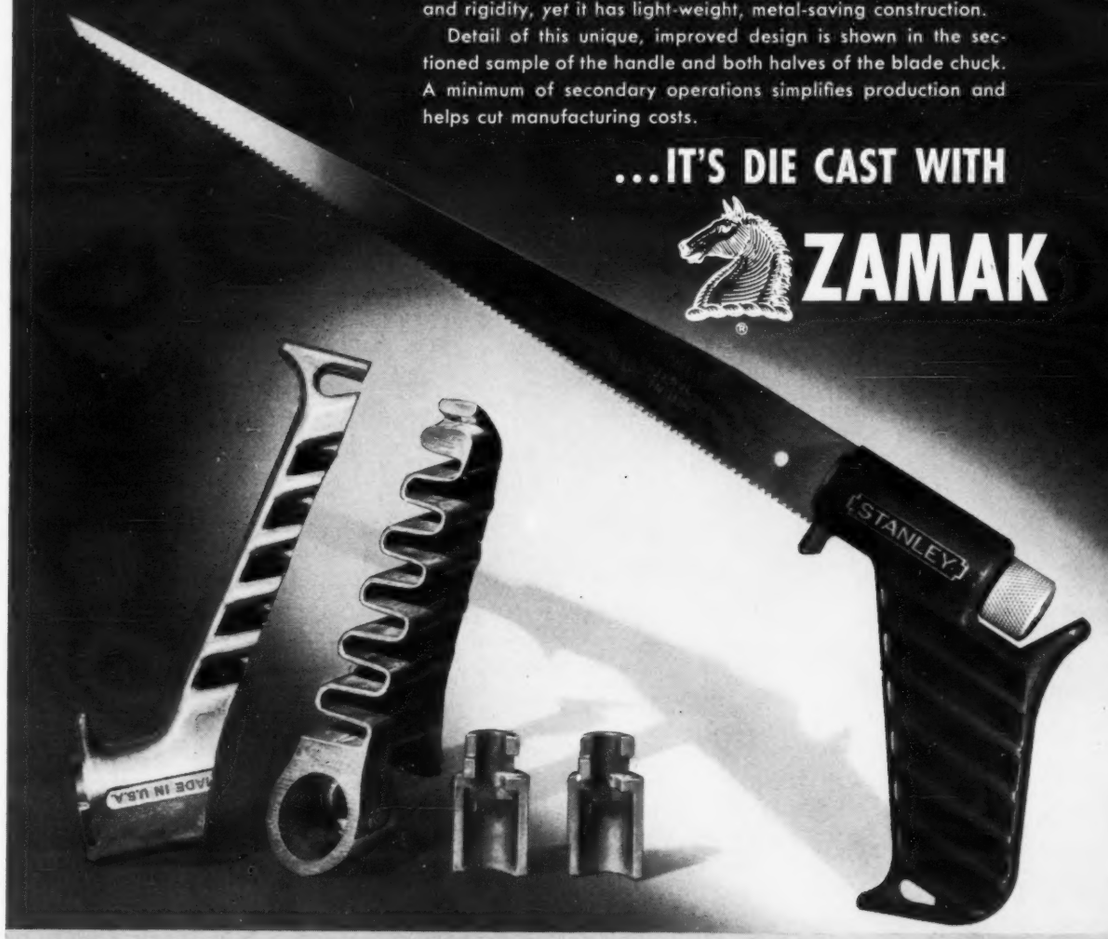
IT'S LIGHTER THAN YOU THINK!

ONE-PIECE CONSTRUCTION with MAN-SIZE GRIP and a MINIMUM OF METAL

The handle of this new keyhole saw, by Stanley Works, is designed for "heft" with a full, man-size grip, exceptional strength and rigidity, yet it has light-weight, metal-saving construction.

Detail of this unique, improved design is shown in the sectioned sample of the handle and both halves of the blade chuck. A minimum of secondary operations simplifies production and helps cut manufacturing costs.

...IT'S DIE CAST WITH ZAMAK®



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THE NEW JERSEY ZINC COMPANY

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HORSE HEAD PRODUCTS®

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DESIGN DATA NEWS

Contact Stresses

F. Caplan, Kaiser Engineers, Oakland, Calif.

The Hertz stress equations are as follows:*

Cylinder in a circular groove

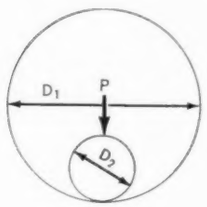
$$S_c = 0.798 \sqrt{\frac{P\left(\frac{D_1 - D_2}{D_1 D_2}\right)}{\left(\frac{1-\mu_1^2}{E_1}\right)+\left(\frac{1-\mu_2^2}{E_2}\right)}} \qquad (1)$$

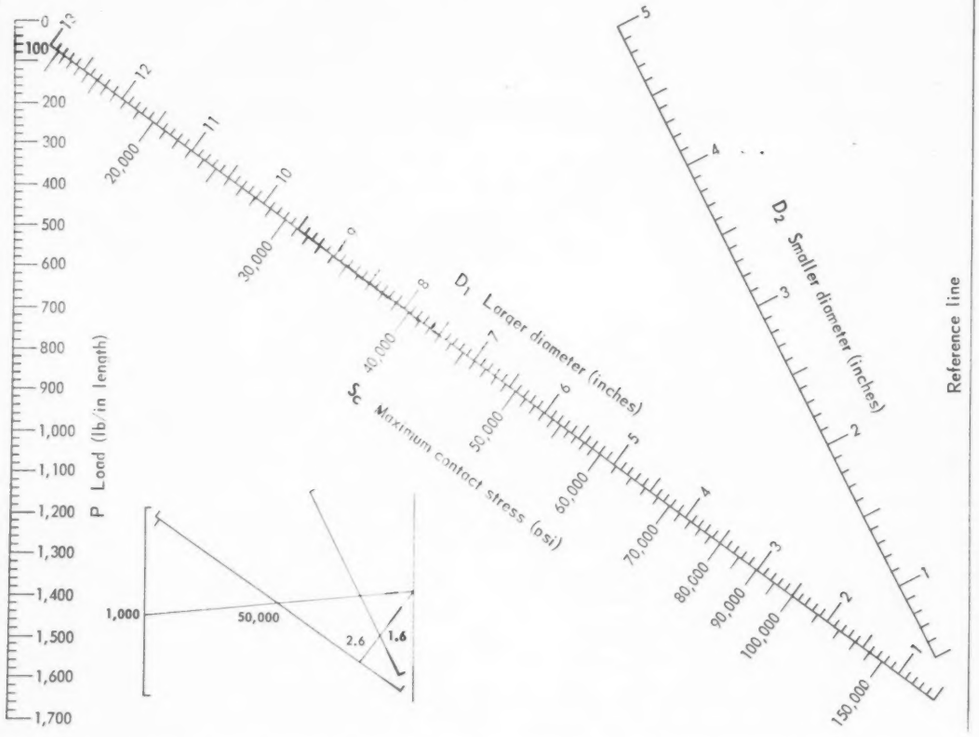
For $E_1 = E_2 = (30)\ (10^6)$ psi and $\mu_1 = \mu_2 = 0.29$, Eq. (1) becomes:

$$S_c = 3{,}230 \sqrt{P\left(\frac{D_1 - D_2}{D_1 D_2}\right)} \qquad (2)$$

(Text continued on page 45)

NOMOGRAM I CONTACT STRESS OF A CYLINDER IN A CIRCULAR GROOVE





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MINIATURE HEADLESS SLOTTED SET SCREWS

. . . put your needs in MOORE'S capable hands

Wherever you require *precision* miniature headless slotted set screws, you can depend on Moore to meet your requirements to complete satisfaction. Prices are right. Delivery is fast. And quality is to the highest industry standards. Available in sizes #0 through #4 in a wide selection of materials, finishes, lengths and points.

Specify Moore and be sure. Dependable quality for over 80 years. Write for price catalog.

MOORE SET SCREWS

George W. Moore, Inc.
since 1880
82 Beaver St., Waltham 54, Mass.

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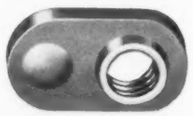
OHIO WELD NUTS

Patent No. 2908310

RN NUT — for projection welding. Ideal where tension is against the weld.

ND NUT — for spotwelding. Used where large nut is needed for bridging two sheets or for extra strength.



PN NUT — for projection welding. Ideal in confined areas, to heavier gages and on curved surfaces.

Patent Applied For

XN NUT—for spotwelding with recessed target electrode area. Full range of sizes can be welded with 20 KVA Welder.

Thread sizes #6-32 to 3/8-16

Samples and information furnished upon request.

The OHIO WELD FASTENERS Primary Fastener in Fastener Assemblies

THE OHIO NUT AND BOLT CO.
24 FIRST STREET BEREA, OHIO

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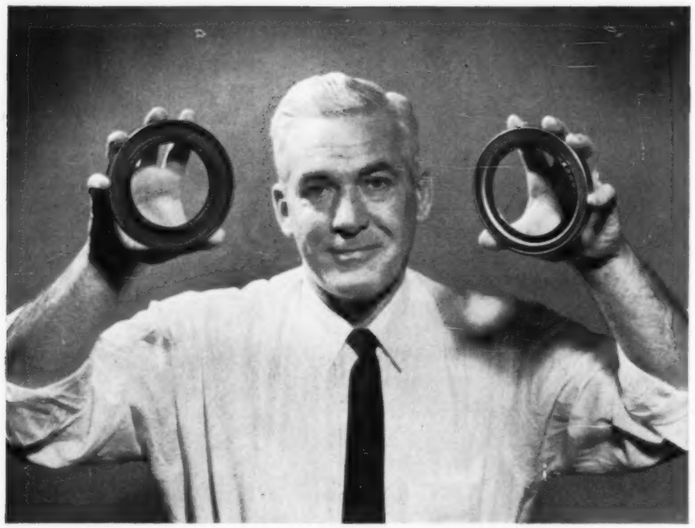

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Two cylinders with parallel axes

$$S_c = 0.798 \sqrt{\frac{P\left(\frac{D_1 + D_2}{D_1 D_2}\right)}{\left(\frac{1 - \mu_1^2}{E_1}\right) + \left(\frac{1 - \mu_2^2}{E_2}\right)}} \qquad (3)$$

For $E_1 = E_2 = (30)\ (10^6)$ psi and $\mu_1 = \mu_2 = 0.29$, Eq. (3) becomes:

$$S_c = 3{,}230 \sqrt{P\left(\frac{D_1 + D_2}{D_1 D_2}\right)} \qquad (4)$$

Cylinder on a flat plate

$$S_c = 0.798 \sqrt{\frac{P}{D\left[\left(\frac{1 - \mu_1^2}{E_1}\right) + \left(\frac{1 - \mu_2^2}{E_2}\right)\right]}} \qquad (5)$$

For $E_1 = E_2 = (30)\ (10^6)$ and $\mu_1 = \mu_2 = 0.29$, Eq. 5 becomes:

$$S_c = 3{,}230 \sqrt{\frac{P}{D}} \qquad (6)$$

Nomenclature:

- S_c = maximum bearing stress, psi
- P = load, lb per inch of length
- D_1 = larger diameter, inches
- D_2 = smaller diameter, inches
- μ_1 = Poisson's ratio for member 1
- μ_2 = Poisson's ratio for member 2
- E_1 = modulus of elasticity for member 1, psi
- E_2 = modulus of elasticity for member 2, psi

Nomogram I is a graphical solution of Eq. 2. Example: What is the minimum diameter of a roller bearing, in a 2.60 ID race, under a load of 1000 lb/inch length, if the bearing stress is to be limited to 50,000 psi?
Align $P = 1000$ with $S_c = 50{,}000$ and continue to reference line. Align this intersection with $D_1 = 2.60$ and read $D_2 = 1.60$ inches.

Nomogram II is a graphical solution of Eq. 4. Example: For $D_1 = 9.0$ inches, $D_2 = 8.0$ inches and $P = 880$ lb/inch length, what is S_c?
Align $D_1 = 9.0$ with $D_2 = 8.0$, intersecting the reference line. Align this intersection with $P = 880$ and read $S_c = 46{,}500$ psi.

Nomogram III is a graphical solution of Eq. 6. Example: What is S_c for $P = 1000$ lb/linear inch and $D = 10.0$ inches?
Align $P = 1000$ with $D = 10$ and read $S_c = 32{,}300$ psi.

**Reference: R. J. Roark "Formulas for Stress and Strain", McGraw-Hill Publishing Co.*

(Continued on next page)

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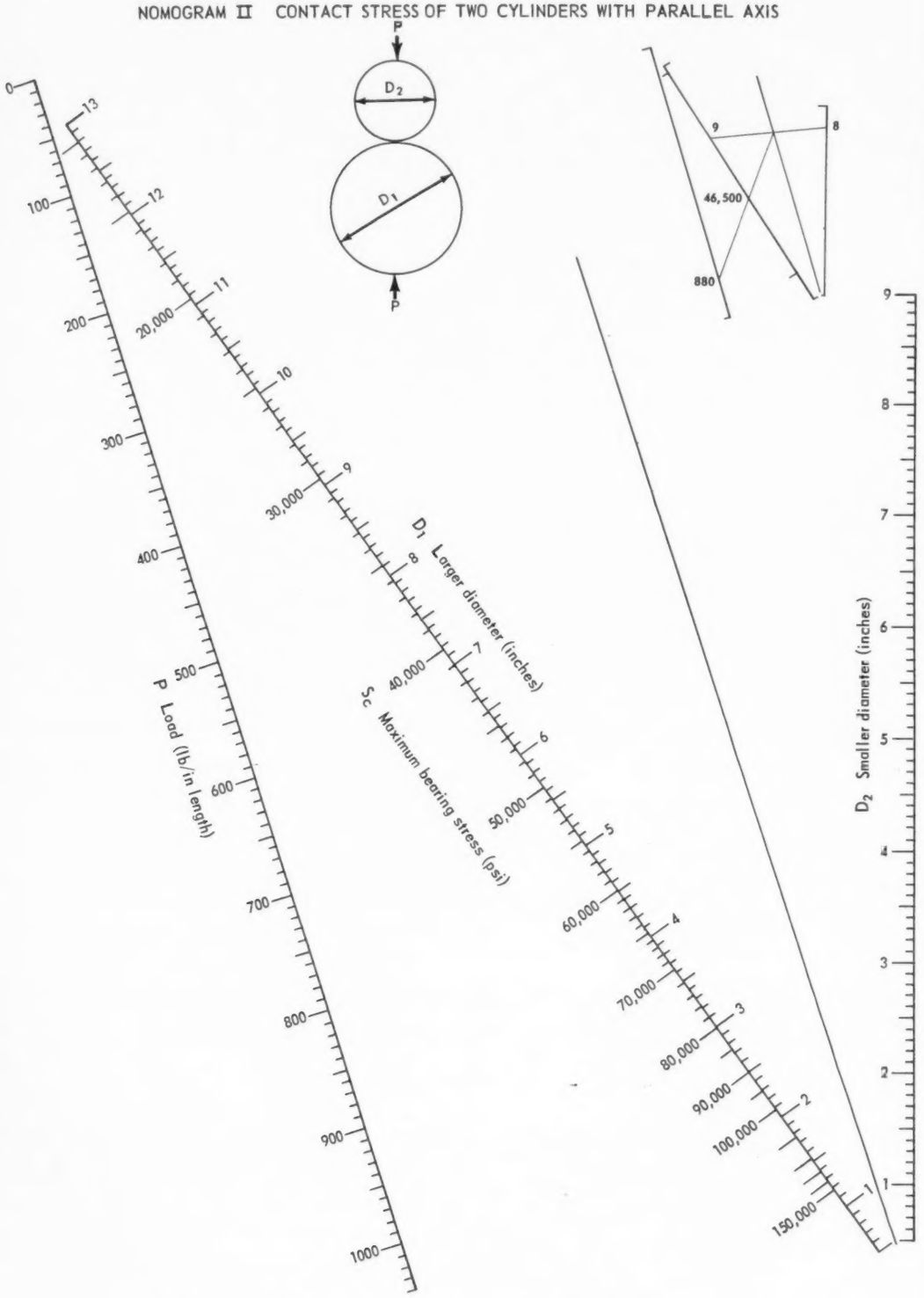
Contact Stresses . . . *Cont.*

NOMOGRAM II CONTACT STRESS OF TWO CYLINDERS WITH PARALLEL AXIS



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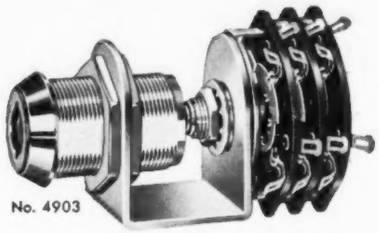
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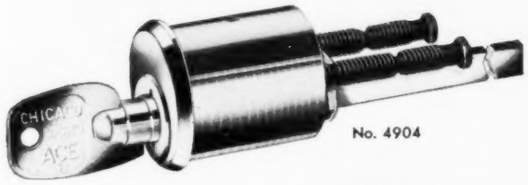
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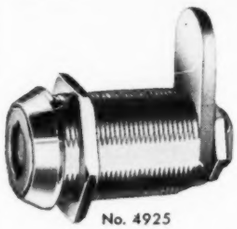
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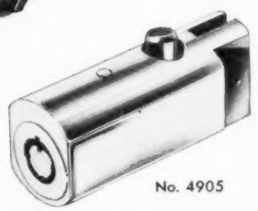
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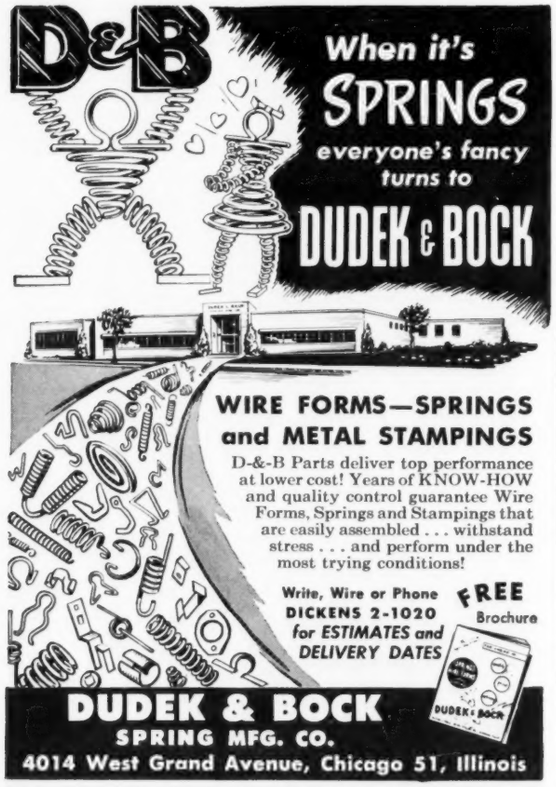
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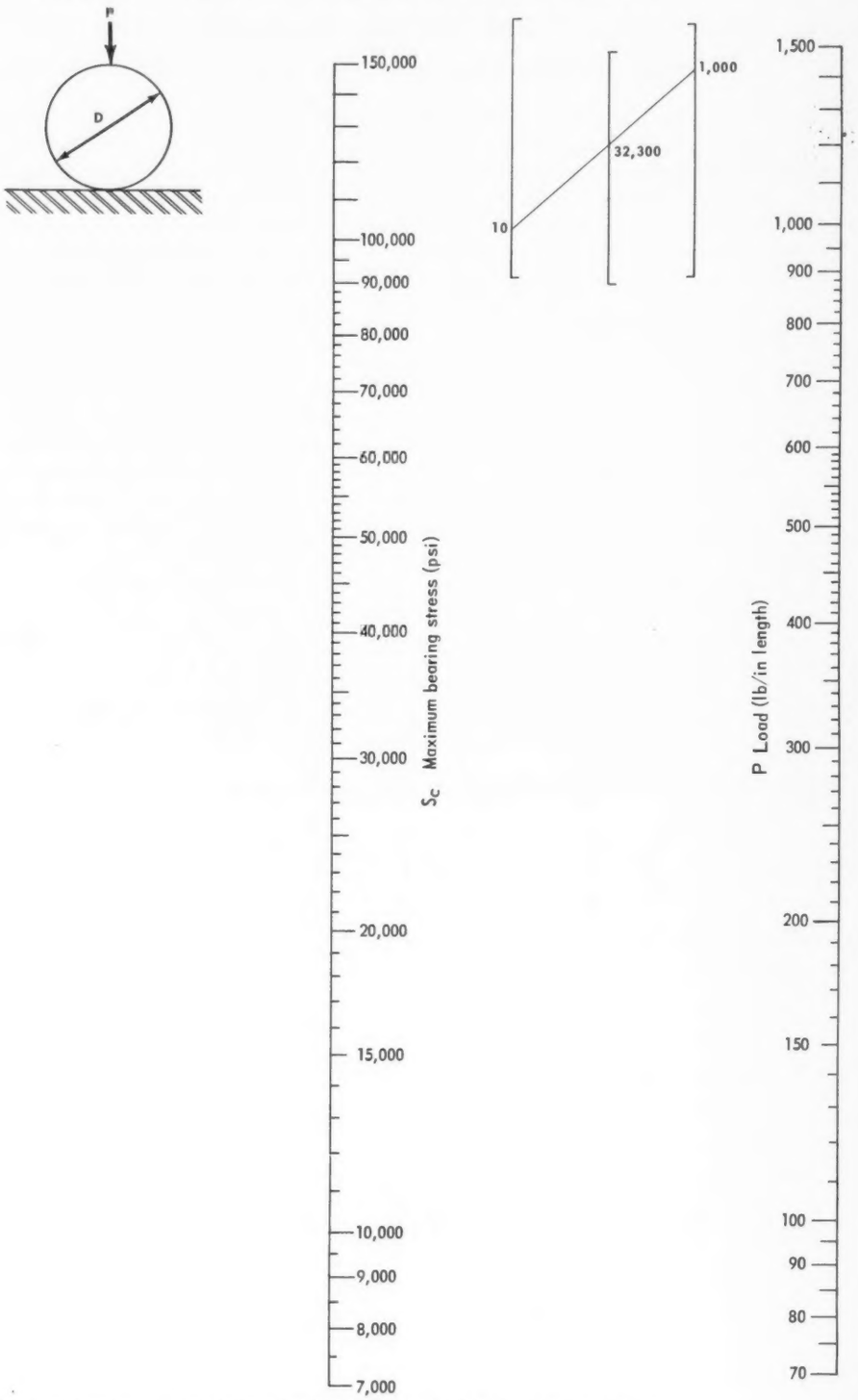
NOMOGRAM III CONTACT STRESS OF A CYLINDER ON A FLAT PLATE



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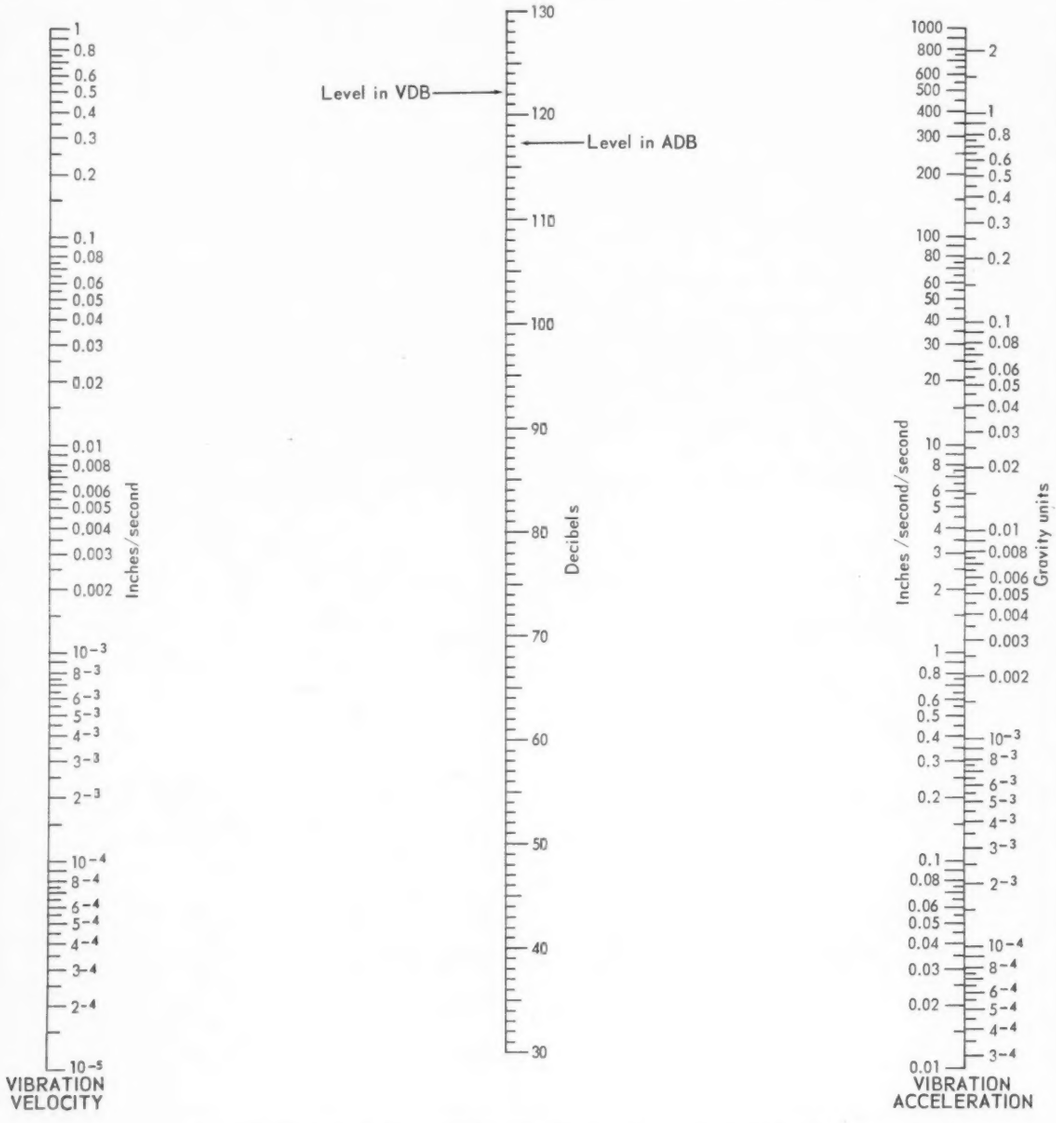
Conversion Chart for Vibration Velocity Level And Vibration Acceleration Level

David P. Costa, Mechanical Engineer, Naval Material Laboratory, Brooklyn, N. Y.

In the field of vibration (or structure-borne sound), it is in general practice to express and measure vibration levels in terms of the decibel. This quantity has always been employed in the field of air-borne sound. The standard expression for the measurement of air-borne sound is the sound pressure level (SPL) and is measured in "db".

Vibration velocity levels expressed in inches/second and vibration acceleration levels expressed in inches/second^2 are expressed conveniently as "vdb", velocity decibels (re 10^{-6} cm/sec), and "adb", acceleration decibels (re 10^{-3} cm/sec^2), respectively.

The accompanying chart permits conversion of vibration level to either system.



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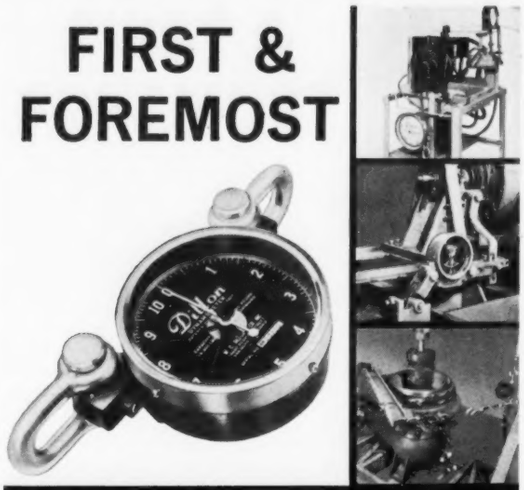

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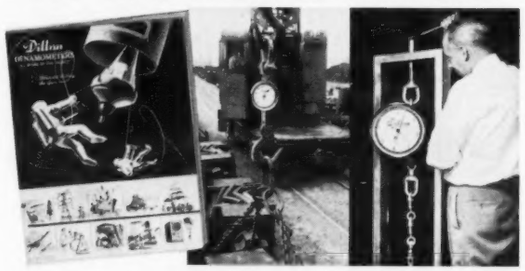

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Bevel Gearing

Actual Number of Teeth—Formative Number of Teeth

Richard Wadler, Mechanical Engineer, Raytheon Co., Bedford, Mass.

The tooth-bending stress in bevel gears is usually calculated by using the Lewis equation:

$$F_T = \frac{SYb}{P_d} \quad (1 - \frac{b}{L})$$

Where:

F_T = safe tooth load
S = allowable bending stress
Y = form factor
b = face width
P_d = diametral pitch
L = pitch cone element

The form factor Y is not based on the actual number of teeth, but on the formative number of teeth. This is the number of teeth of the same pitch as the bevel gear, which would be contained in an imaginary spur gear, having a radius R equal to the back cone radius R_B (Fig. 1).

The nomogram represents the equation

$$N_F = N_A/\cos\lambda$$

Where:

N_F = formative number of teeth
N_A = actual number of teeth
λ = pitch cone angle

Example:

Find the formative number of teeth in a straight-tooth bevel gear having 16 teeth and a pitch cone angle of 60 deg.

Solution:

Align $\lambda = 60$ deg with $N_A = 16$ teeth and read $N_F = 32$ teeth.

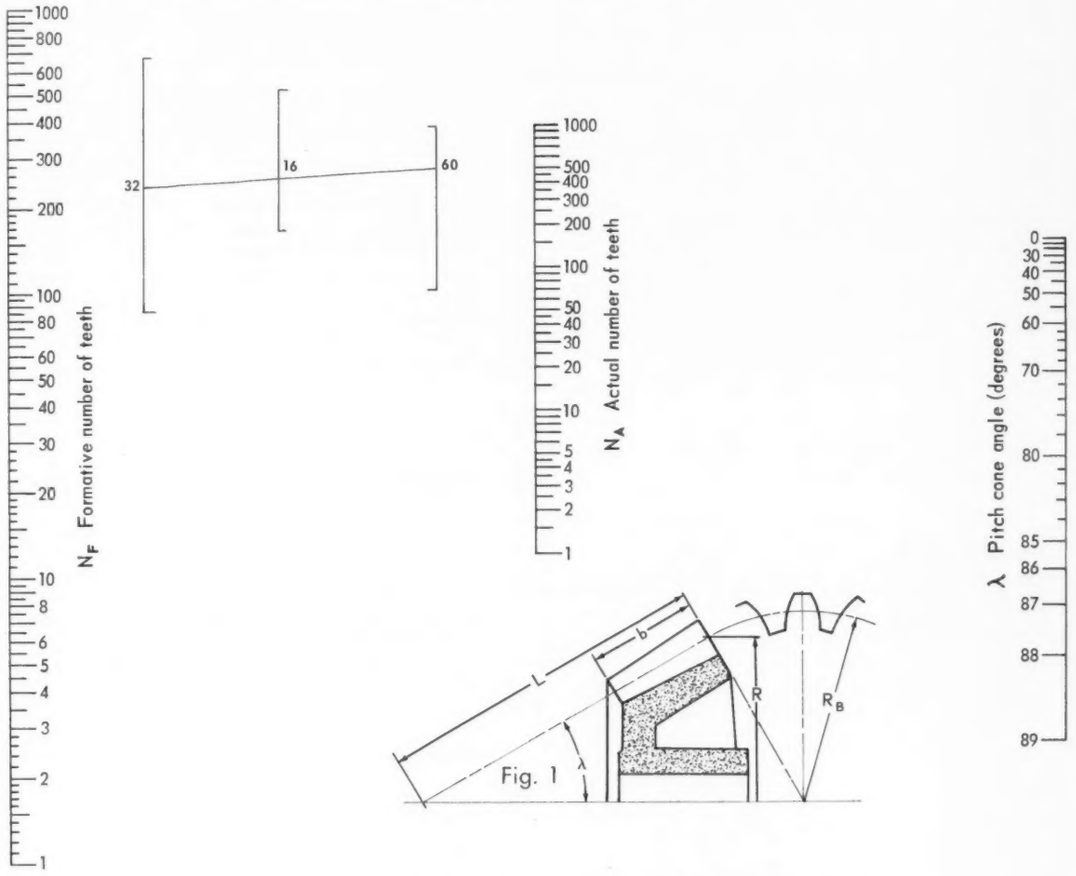

Fig. 1

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Nomograph Calculators 451

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Audio Accessories 452

A valuable guide for hi-fi and stereo enthusiast or professional. Catalog 15 contains information on tape accessories, record accessory kits, tape splicers, phono accessories, replacement parts and recording heads. Robins Industries Corp., 36-27 Prince St., Flushing 54, N. Y.

Stainless Fastener Guide 453

A question-and-answer guide to industrial applications of austenitic stainless-steel fasteners. The 6-page folder reviews in capsule form main features of the stainless family (200 and 300 series). Included are 18-8 chromium-nickel group's corrosion resistance, scale resistance to 800F, low-temperature usage to —300F, low-magnetic permeability and strengthening by cold working of non-heat treatable alloy. Standard Pressed Steel Co., Box 778, Jenkintown, Pa.

Free Loan Technical Films 454

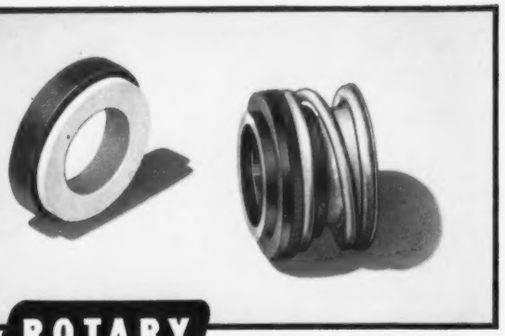
More than 130 films dealing with specific technical subjects are offered on free loan for the asking in this catalog. The listing includes topics in the realm of the pure sciences as well as those affecting practical considerations of production and distribution. Almost all basic American industries are represented by one or more films described in the catalog. Modern Talking Picture Service, Inc., 3 E. 54th St., New York 22, N. Y.

Binaural/Monaural Headphones 455

1961 dynamic headphone catalog entitled "Stereo-Fones and Dimensi-Fones". Included in the 4-page brochure are complete descriptions and prices of all binaural and monaural headphones available. In addition, the catalog gives a complete list of adapters which will enable headphones to be used with any type of equipment, together with a a list of replacement parts. Permoflux Products Co., 4101 San Fernando Rd., Glendale 4, Calif.

Magnetic-Disc Brakes 456

Gives information on a complete line of brakes available from any single source. Also included is complete engineering data along with dimensional information. Stearns Electric Corp., 120 N. Broadway, Milwaukee 2, Wisc.



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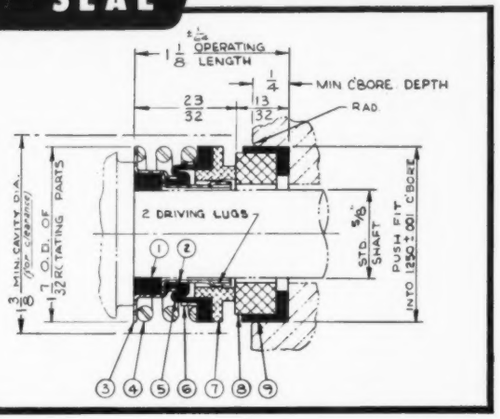

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'Engineering Application Data' 457

Helpful up-to-date information is provided for those interested in overhead materials handling. Various types of carriers, cranes, tractors, track switches, grabs and electrification are described. Detailed studies of track design, peening and stresses are given. A large number of photographs of a wide variety of installations are also featured. Ask for booklet No. 2008-Q. Cleveland Crane & Engineering Co., Cleveland Tramrail Div., Wickliffe, Ohio.

'Fluidics' Buyers Guide 458

This 16-page bulletin is of interest to all companies handling or processing liquids or gases. The brochure explains Fluidics—the science of fluid processes. The guide is divided into two sections, each illustrated with application photos and concise engineering data indicating the manner in which the company will plan, engineer, and manufacture equipment for specific unit operations or integrated continuous operation. Pfaudler Div. of Pfaudler Permutit Inc., 1121 West Ave., Rochester, N. Y.

Electrical Insulation 459

Illustrated with both product and application pictures and containing up-to-date products and price information, catalog 39 covers insulation for repair and maintenance of motors, generators and electrical or electronic equipment. All listed products are temperature rated by AIEE classifications for convenience in selection. Among products listed for the first time are two epoxy repair kits, a Class H silicone encapsulation repair kit and a new Class F epoxy glass formed wedge. Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6, Ill.

Titanium Alloy 460

An alloy for use in jet engines is discussed in a Data Memorandum. The 12-page manual, "Properties of Ti-8Al-1Mo-1V", outlines forging and heat-treat procedures for the alloy and includes discussion of its creep, stability and fatigue properties. Titanium Metals Corp. of America, 233 Broadway, New York 7, N. Y.

Precision Snap-Action Switches 461

1961 catalog. This 32-page edition features a unique 4-page technical discussion of switches and switch terminology, as well as complete and concise product descriptions. Product descriptions of hermetically-sealed and environment-free switches also appear. This is a must for any user of snap-action switches. Illinois Tool Works, Licon Div., 6606 W. Dakin, Chicago 34, Ill.

Medium Power Silicon Diodes 462

Contains technical data and product information. This brochure lists a new line of industrial, commercial, electronic and military power-type silicon diodes. Lines are shown in round and hexagonal axial lead package configurations. Performance characteristics, ordering instructions and general technical data are included. Charts and curves illustrate operational characteristics. Controls Co. of America, Electron Div., Tempe, Ariz.

Precision Potentiometers 463

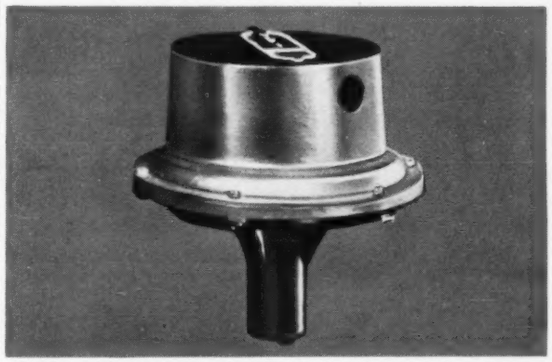
Contains six product data sheets describing series of wire-wound multi and single-turn potentiometers. Complete application information is given, including applicable military specifications and environmental data. Lockheed Electronics Co., 6201 E. Randolph St., Los Angeles 22, Calif.

Electronic Components 464

An 8-page illustrated catalog, No. 1060, covering electronic components, connectors, switches and hardware. Complete descriptions and specifications on all items are included. Featured is information on use and availability of color-coded connector cables. Zoron, Inc., 612 W. Monroe St., Chicago 6, Ill.

Reevecote broadens use of popular air switch with stronger—more sensitive diaphragms

T. H. Landgraf, Chief Engineer at The Autogas Company of Bellwood, Illinois, says: "The use of a Reevecote diaphragm allows a wider range of control of all kinds of gases, wider temperature range and provides greater strength."



The Shure-Vent Control, product of The Autogas Company, is an increasingly popular air-flow interlocking switch. It is actuated by a strong, sensitive Reevecote diaphragm. Operation is by pressure or vacuum.

Since the heart of this control is its diaphragm, The Autogas Company found the perfect solution in a larger, stronger, more sensitive diaphragm made of Reevecote, a synthetic rubber-coated fabric manufactured by Reeves Brothers, Inc.

If your design calls for a diaphragm – or the use of coated fabrics . . . choose from over 200 styles of Reevecote – the most complete line of coated fabrics for industry.

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Reeves Brothers, Inc., Vulcan Rubber Products Division
1071 Avenue of the Americas · New York 18, New York

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Trends in VTOL Aircraft Propulsion System Requirements

J. B. Nichols, Hiller Aircraft Corp., Palo Alto, Calif.

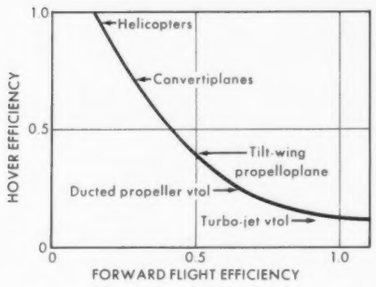


Fig. 1

Fig. 2

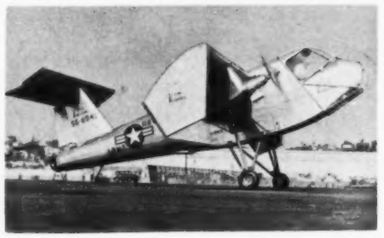


Fig. 3

Fig. 4

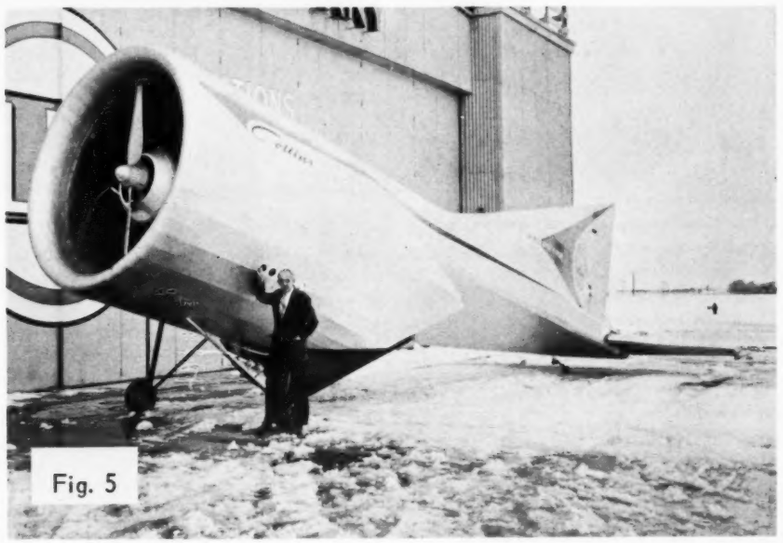


Fig. 5

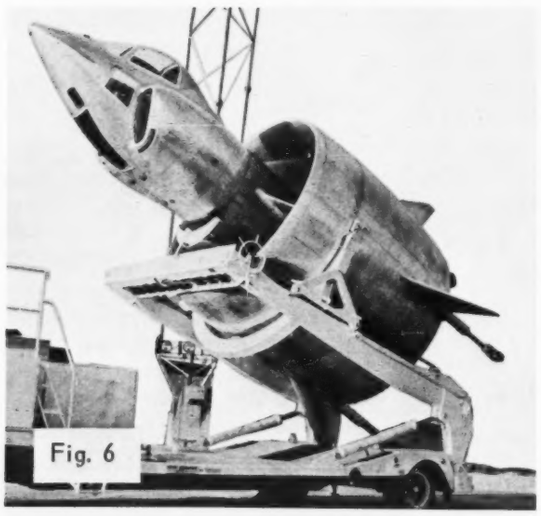


Fig. 6

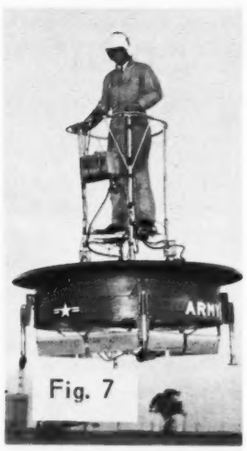


Fig. 7

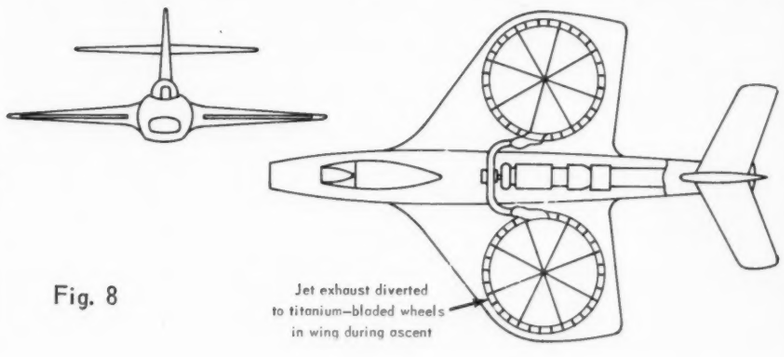


Fig. 8

There are many missions in the air transport spectrum which lie between the helicopter's capabilities and those of the airplane. These missions demand a considerably higher transport effectiveness than the helicopter and also require vertical take-off and landing capabilities but without the need for protracted hovering or low-speed flight. Fig. 1 shows performance of various types of VTOL aircraft plotted on a hovering efficiency versus forward flight efficiency diagram. Figs. 2, 3, 4 and 5 present some current VTOL aircraft in the order of increasing disc loadings.

Propulsion System Requirements

While the tilt-wing looks extremely promising, the payload ratio of this type of aircraft is less than that of a conventional airplane. Alternately, a propelloplane will be considerably larger than a conventional airplane carrying the same payload. This size growth factor is directly related to propulsion lifting system weights which are less under the control of the airframe manufacturer than under the control of the power-plant, transmission and propeller manufacturers.

Since weight control appears to be the primary key to successful VTOL aircraft, there will continue to be a premium for components with combined or multi-purpose functions.

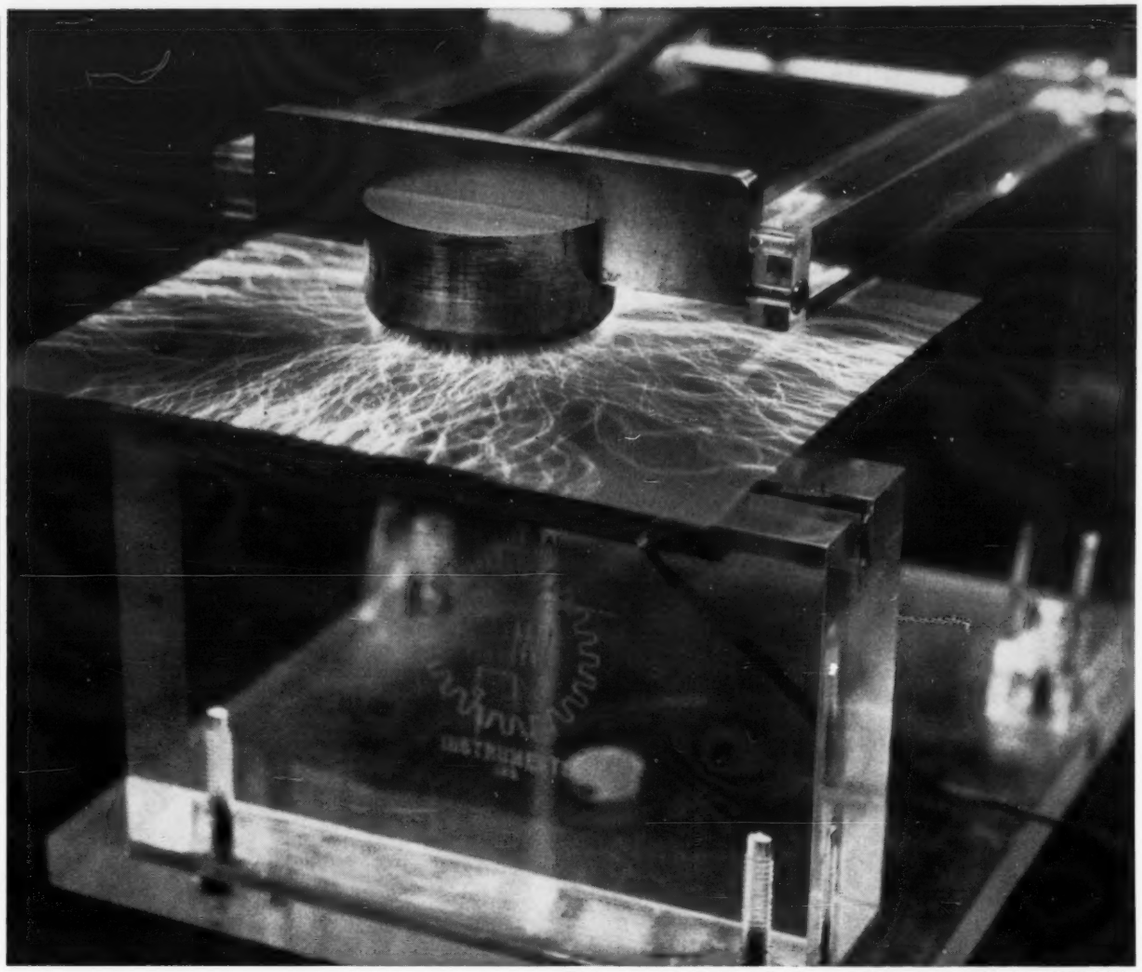
The Ring Wing, or "Coleopter", (Fig. 6) is an example of an integrated aircraft. In this machine, the shroud of the ducted propeller or jet engine also acts as a wing in forward flight. The well-known Hiller Flying Platform (Fig. 7) represents a static augmentation application.

An alternate approach to an integrated aircraft employs a ducted fan to augment the hovering thrust capability of a turbojet engine (Fig. 8). This scheme has been proposed by Breuget in France, and a number of companies in this country. General Electric has also been carrying on development work on propulsion systems for such applications.

Conclusions

Immediate needs of the VTOL aircraft industry are for a continuation of the downward trend in turboshaft engine weight and the development of a wider variety of sizes of available hardware engines. Furthermore, gear boxes should be designed with provisions for cross-shafting between engines. In addition, there must be some real effort expended in reducing propeller weights.

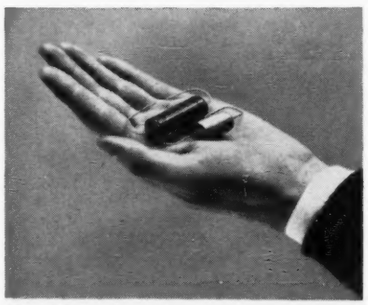
Abstracted from a technical paper, "Trends in VTOL Aircraft Propulsion System Requirements"; SAE No. 174B; 75 cents; to SAE members, 50 cents. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.



This is an actual photograph of "Mylar" undergoing dielectric strength test (per ASTM-D-149).

MYLAR® has a dielectric strength of 4,000 volts per mil

Can the unique combination of properties found in "Mylar" help you solve your design problems?



High dielectric strength helps cut capacitor size. Tough, thin "Mylar" with a dielectric strength of 4,000 volts per mil for 1 mil film (per ASTM-D-149) permits capacitor manufacturers to reduce size of finished unit . . . improve performance and reliability.

"Mylar"* polyester film is a tough, flexible engineering material. In addition to its outstanding dielectric strength, "Mylar" has an average tensile strength of 20,000 psi, withstands temperature extremes (-60° to 150° C.) . . . resists most chemicals and moisture.

On an area basis, tough, thin "Mylar" often *costs less* than heavier, conventional materials. "Mylar" can be laminated, embossed and metalized, punched or coated. The film won't embrittle with age. "Mylar" is available in roll or sheet form in a wide range of gauges.

Find out how the *combination of properties* in "Mylar" can help you solve knotty design problems, improve product performance or cut costs. Write for our booklet containing detailed information on properties and applications. E. I. du Pont de Nemours & Co. (Inc.), Film Dept., Room D-1, Wilmington 98, Del.

*"Mylar" is Du Pont's registered trademark for its brand of polyester film.

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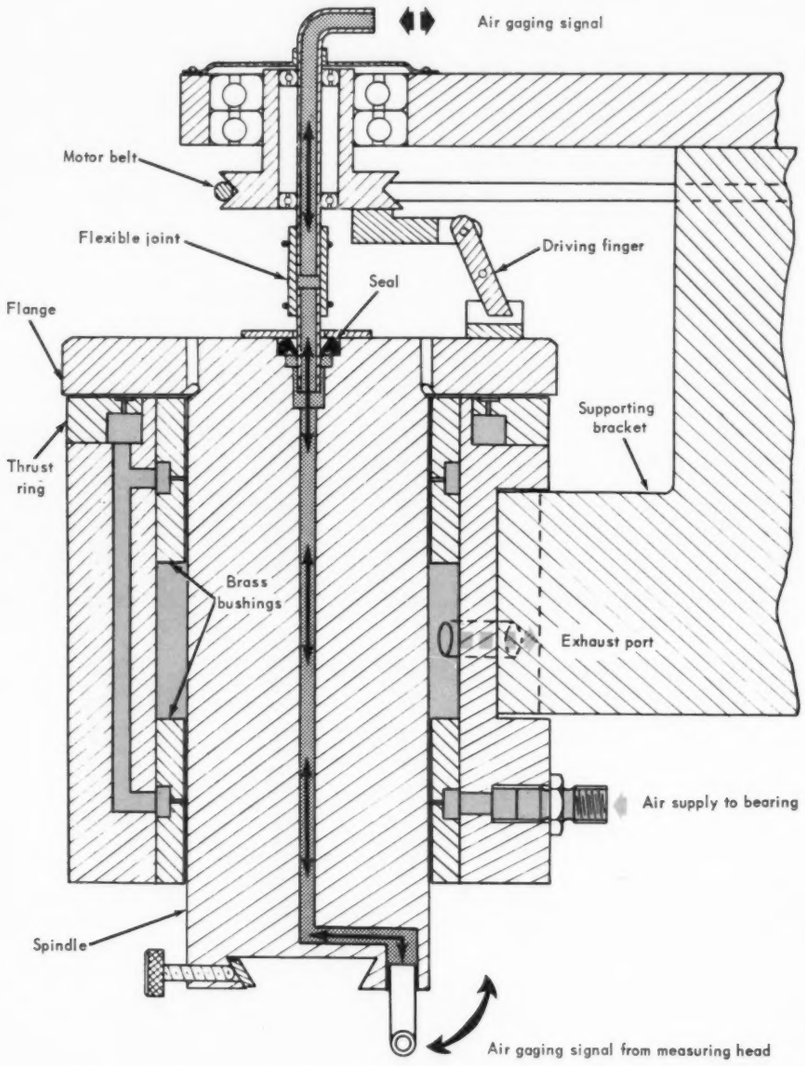
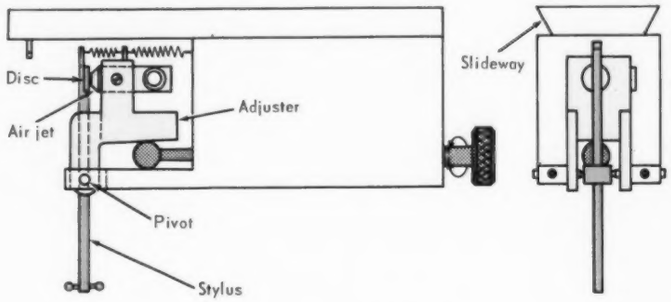
DESIGN IDEAS NEWS

Air-Bearing System Provides Rotational Accuracy in Roundness Gage

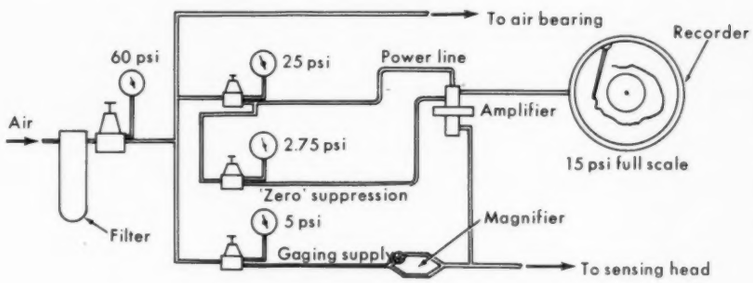
Ronald W. E. Martin, British Editor



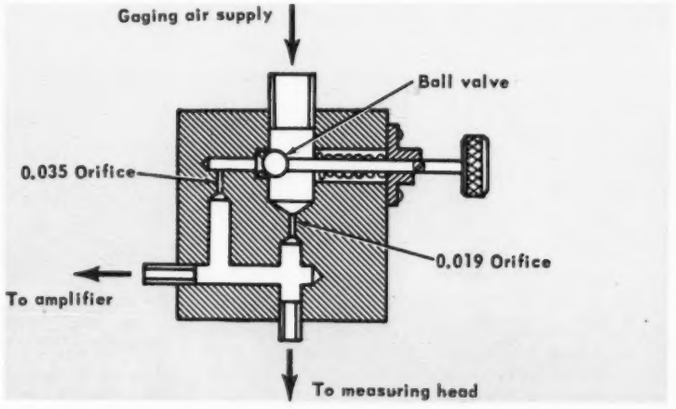
BUSHINGS are honed in line for concentricity. Spindle is finish-ground at one setting, squareness with flange is held to within 0.00015 inch. Lapping of spindle reduces true roundness error to 0.00002 inch. Radial clearance between spindle and bushings of 0.00065 inch provides stiffness characteristic for operating air pressure of 60 psi. Under conditions of symmetrical loading, radial and axial stiffness values approximate 80,000 and 200,000 psi, respectively. Bearing air consumption is about 3 cfm, equivalent to ¾-hp compressor. Air to sensing head is sealed by synthetic rubber lip-type seal, lubricated with silicone vacuum grease.



SENSING HEAD mounts in dovetail slide on end of spindle, for positioning of stylus. Adjustment of gap between air jet and metal disc is by screw-operated ball and wedge.



PNEUMATIC CIRCUIT DIAGRAM of roundness measuring instrument. Filtered compressed air regulated to 60 psi is fed directly to air-bearing unit. Some of this air is regulated further and fed to air-gaging circuit at 5 psi. System regulates pressures for linear output at recorder.



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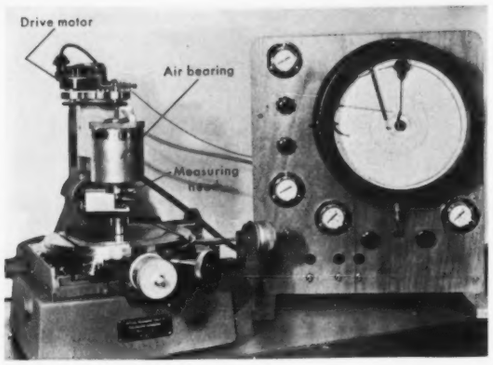

The air-bearing system of a pneumatic roundness gage provides a simple but accurate reference of rotation capable of sensing a runout of 0.00001 inch. Other benefits of the design are low maintenance requirements and freedom from wear.

The vertically-mounted airborne spindle carries an adjustable pneumatic sensing head at its lower end. Two synchronous motors, one on the spindle support bracket, the other in the chart recorder, rotate spindle and chart at identical speed. Compressed air is fed to the bearing through an inlet port, to two brass bushings each having 10 radial orifices (0.015 inch dia), and to a thrust ring with four orifices. These thrust jets are set in a shallow annular groove in the thrust ring face so that their action is integrated. Arrangement prevents spindle tilting cyclically during rotation should its flange be slightly out of square.

The sensing head contains a jet tube from which compressed air impinges on a flat metal disc attached to the upper end of a pivoted stylus. Air is supplied to the jet through a flexible tube attached to the spindle. The ball-ended stylus rod can be biased to act inwardly or outwardly. Movement of stylus due to component errors causes an equal movement of the disc, which, in turn, affects the rate at which air escapes from the jet orifice. Resulting "back pressure" variation is thus a measure of runout.

The roundness measuring instrument is a development of the Mechanism, Metrology and Noise Control Div. of Britain's National Engineering Laboratory.

♦

MAGNIFICATION UNIT provides: low value for initial centering and measurement of coarse work, higher value for use on precision components. It consists of two control orifices, 0.019 and 0.035 inch dia, and valve to shut off air flow through larger orifice. With valve open, both orifices are connected in parallel and pass air to measuring head orifice of 0.063 inch dia, giving magnification at chart pen of close to 1000. By closing valve, air is passed only by smaller orifice which results in higher magnification of close to 5000. Chart paper has radial divisions of ⅛ inch, making each division equivalent to stylus displacements of 0.000125 and 0.000025 inch, respectively.

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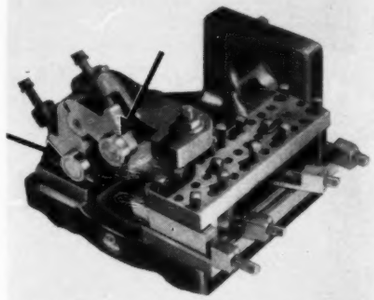
GISHOLT MACHINE COMPANY incorporates McGILL CAMROL® bearing accuracy into tooling set-ups



Gisholt Machine Company takes advantage of the cost and performance features of CAMROL CF series bearings, (with integral stud), on a group of standard bar tools for mounting on the turrets of Gisholt Masterline Turret Lathes. A representative tool of this group is the Multiple Cutter Turner shown.

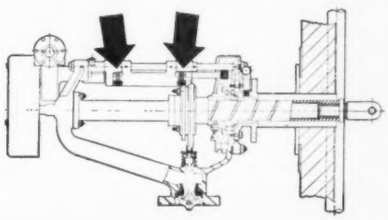
McGILL® CAMROL® BEARINGS

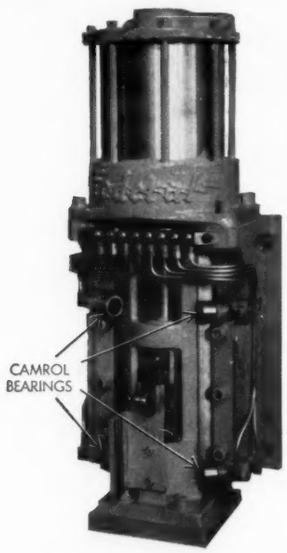
are proven performers—with cost and assembly advantages

McGILL CAMROL bearings have rolled up an unequalled 25-year history of high performance and dependability — with the cost savings of standard bearings over built up shaft and roller units. They eliminate the time-consuming intricacies of procurement and assembly of parts for improvised bolt, bearing and washer followers. You, too, can rely on the designed-in ability of CAMROL bearings to accept intermittent shock and fluctuating heavy loading coincident to cam action, track or guide and support applications. CAMROL bearings are built for stock in roller diameters from ½" to 4" in the CF series with integral stud and the CYR series for shaft mounting. Both types are available with or without positive, integral seals for retention of prelubrication and protection against contaminants. Following are typical applications.

CF CAMROL® bearings provide rolling contact in automatic soot blowers

Diamond Power Specialty Corporation has incorporated McGILL CAMROL bearings into the design of their Model IR Short Retraction blowers to produce a smooth rolling contact between cam flange and latch bar. This equipment is used for cleaning water cooled furnace walls, hopper slopes or narrow portions of tube banks adjacent to walls automatically.





FEDERAL MACHINE and WELDER COMPANY puts McGILL uniform quality into welding equipment

The anti-friction welder head unit, shown, is one of the several applications of McGILL CF CAMROL bearings in Federal Machine and Welder Co. equipment. CAMROL bearings are used in weld heads, transfer slides and various other uses where a precision, smooth, uniform movement is desired. Low cost, uniform quality, excellent performance and exceptional length of life are benefits gained in eleven years of use of CAMROL bearings.

Both the regular CF Series and the prelubricated and sealed SCF Series CAMROL bearings are used in Federal equipment.

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precision needle roller bearings

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203 N. Lafayette Street, Valparaiso, Indiana

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NEW! Pneu-trol® QUICK EXHAUST VALVE

Fast air dumping AT THE CYLINDER permits use of smaller valves and piping . . . INCREASES EFFICIENCY AND SPEEDS

Operating Pressures: 1 to 125 PSI For 3/8" and 1/4" pipe sizes

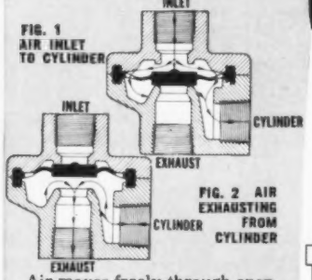
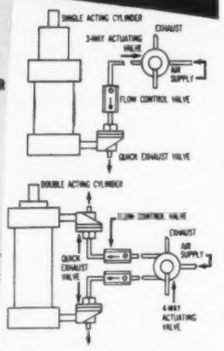


FIG. 1 AIR INLET TO CYLINDER

FIG. 2 AIR EXHAUSTING FROM CYLINDER

Air moves freely through open passages formed by 12 holes spaced around periphery of diaphragm and into cylinder (Fig. 1). When inlet pressure is relieved (by actuating valve in control circuit) the buildup of cylinder return pressure closes inlet holes and snaps the plug off exhaust port (Fig. 2) closing inlet port and allowing instantaneous evacuation of exhaust air. *Write for complete details, specifications and prices.*



TYPICAL APPLICATIONS of Quick Exhaust Valves in Single and Double Acting Cylinders. Because exhaust air is dumped at cylinder, smaller diameter piping and smaller selector valves can be used.

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Integral shut-off valve provides fast connection on production set-ups . . . one hand operation permits fast, easy connecting or disconnecting.

360° swivel action reduces operator fatigue and eliminates aggravating hose kinking and twisting.

The **Series D interchangeable** coupling can be used on air, gases, or liquid lines which makes it ideal for most industrial uses. Maximum flow with minimum pressure drop.

The performance and construction of the Series D Coupling meets Military Specifications MIL-C-4109-A.

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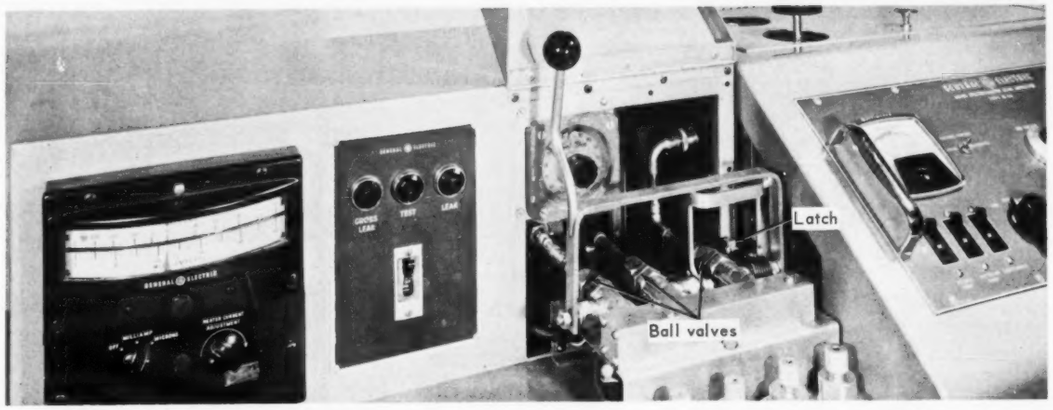
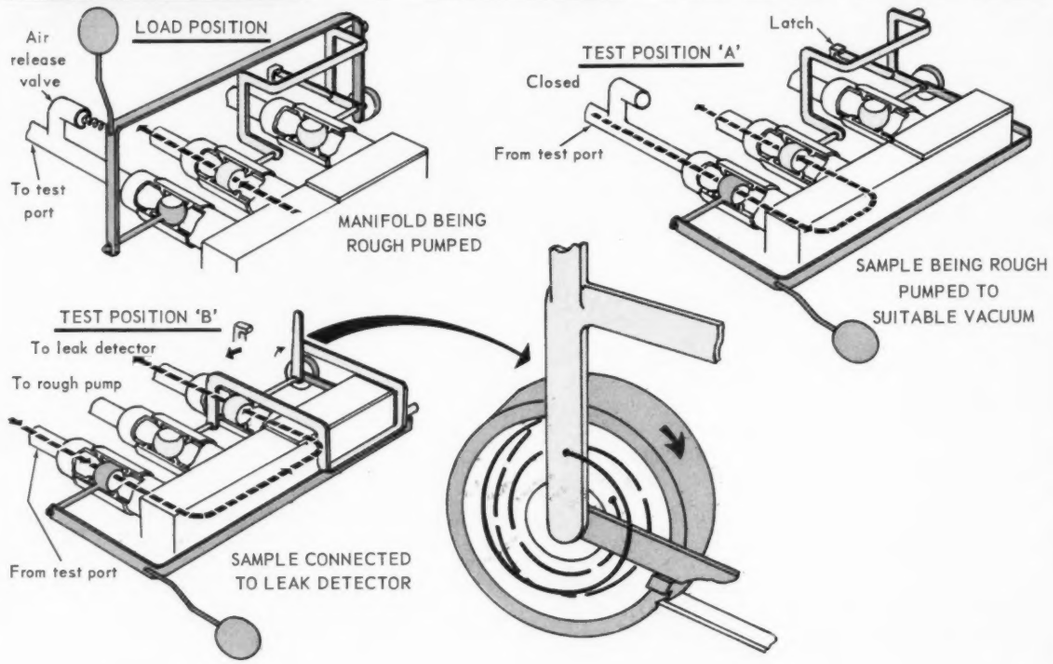
Ball Valves Simplify Leak Testing, Reduce Moving Parts

Victor W. Wigotsky, Eastern Editor





MOVING HANDLE TO VERTICAL POSITION closes detector and test port valves for rough pumping of manifold. Valve to sample is then opened by moving handle down. Simple latch keeps other valves in same position. When desired vacuum is achieved, small solenoid releases latch and spring-loaded bracket opens valve to detector and closes valve to pump. Outside of evacuated sample is then sprayed with helium to test for leaks to detector. Raising handle back to load position restores valves for next test and air-releases sample for easy removal. In case of breakage or accidental removal of sample, fast pressure rise in detector causes pressure gage to turn off filament and energize a solenoid to release spring-loaded handle latch. This closes detector and sample ports. Springs for two levers are anchored to same housing, assuring force in same direction for fast reaction.

in Mass Spectrometer

A ball valve mechanism is used in a new leak detection test table. The valves are spring-loaded and automatically trip in sequence. Design improves equipment simplicity and reliability. Unit semi-automates operation of the mass spectrometer with which it is used.

Original system used solenoid valves. However, in the high-vacuum application, it is desirable to reduce moving parts and eliminate transfer of solenoid-plunger motion into valve seat motion. This would avoid possibility of valves not closing vacuum-tight.

In the simplified method, spring-loaded ball valves are used with a latch arrangement. Start of cycle and reset for next test are accomplished by manual depression and return of a single handle. The rest of the cycle is sequenced automatically.

The new semi-automatic test station was designed by W. E. Briggs and D. M. Ihle, General Electric Instrument Dept., West Lynn, Mass., for G. E.'s M-60 Mass Spectrometer Leak Detector.

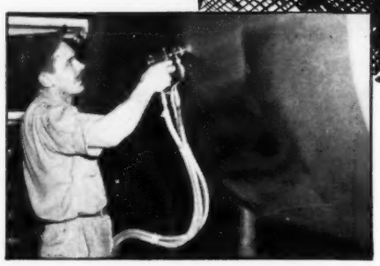
TEST TABLE EVACUATES SAMPLE and valves it to leak detector. Red light on table indicates unacceptable leak level.

This won't stop corrosion–

but versatile-flexible

TYGON® WILL!

Simply crossing the fingers doesn't help much when it comes to corrosion control. But a sure-fire method—and much more economical in the long run—is to specify Tygon if corrosion is a problem in any product you make. Available in a variety of convenient forms and job-specified formulations, Tygon offers superior resistance to a wide range of acids, alkalies, salts, alcohols, oils and solvents.



AS A COATING

Easily applied by brush, spray, dip or roller-coat, Tygon forms a fast-cure, tough, impermeable plastic barrier that seals out corrosive fumes and acids. Gives equipment longer lasting protection against chemical attack and extreme moisture.

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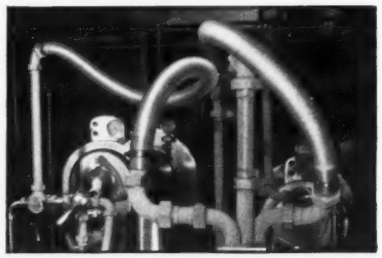
Tygon Sheeting offers heavy-duty protection against corrosive solutions in storage and processing tanks of all shapes and sizes. Easier to install, handles many of the tough jobs rubber and other linings cannot do.

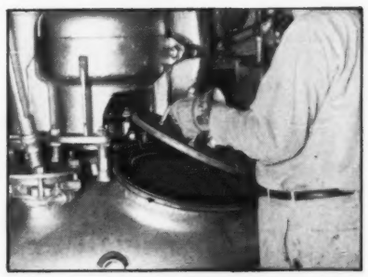


AS TUBING OR HOSE

Flexible, glass-clear Tygon Tubing is ideal for piping flavor-sensitive liquid foods or corrosive chemicals. Non-toxic, non-contaminating, sterilizable. Tough, durable, abrasion-resistant for long service life. Available 1/16" to 4" I.D.

AS GASKETING

Tough, resilient Tygon Gasketing assures tight, durable, leak-proof sealing Its excellent chemical resistance eliminates costly corrosion "trouble spots" where other materials fail Cut from sheet, tubing, solid cord, or molded to your specifications.



Write for detailed Tygon Portfolio today—or ask our engineering staff to recommend the proper Tygon formulation for your application.

445-F

PLASTICS AND SYNTHETICS DIVISION

U. S. STONEWARE

AKRON 9, OHIO

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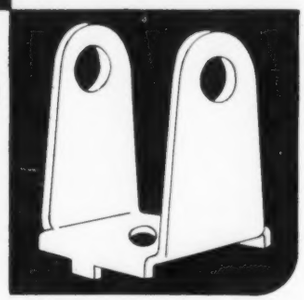
Saved 65¢ per part



Casting & Machining **$1.18**

Stamping **$.53**

SEND SKETCH, BLUEPRINT OR PART, PLUS QUANTITY FOR PROMPT QUOTATION.

DAYTON ROGERS
Manufacturing Company
2824—13th Ave. So., Minneapolis 7U, Minn.

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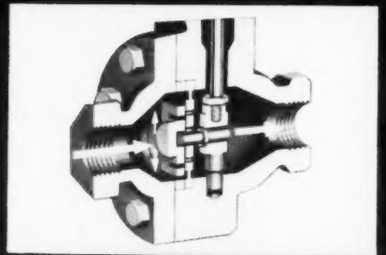
CONTROL VALVES



with
SLIDING GATE SEATS

Control Valves need not be marvels of complex design to give you close control. Look at the simplicity of the OPW-Jordan Sliding Gate Control Valve. Yet it gives you excellent control, less down time and far fewer maintenance headaches.

The answer lies in the self-cleaning, self-lapping action of the Sliding Gate Seats.

Why not get the facts? Write for free illustrated Handbook J170-1. Send for your copy today.

DCV-2

OPW-JORDAN
6013 Wiehe Road
Cincinnati 13, Ohio
EL 1-1352

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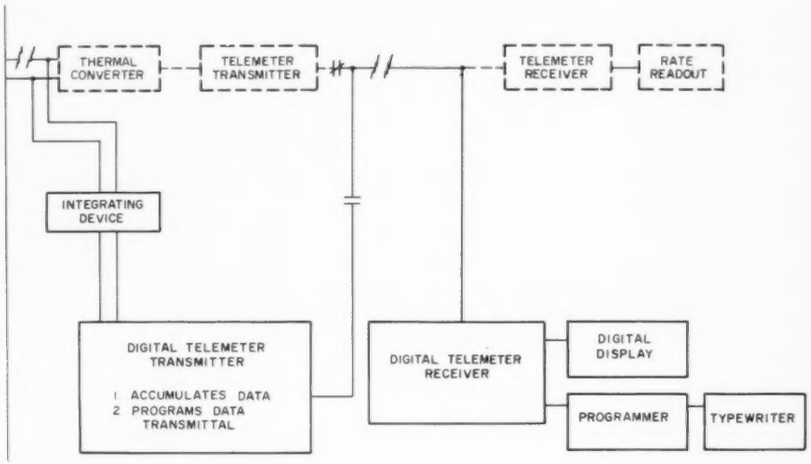
SCANNING PRESS RELEASES

• **DIGITAL TELEMETERING SYSTEM** makes possible transmission of integrated data over existing analog telemeter channels. The system is designed to accumulate and register digital data inexpensively and with the usual high accuracy inherent to digital techniques. It is believed to be the first such equipment available that can share an existing frequency-type channel.

A typical application for the device will be to transmit and record kilowatt-hour data from electric utility tie-lines and substations. In the case of tie-line applications, the equipment will handle both "kwh-in" and "kwh-out" data.

The system's transmitter accumulates pulse signals and sends totalized data to the receiver at intervals programmed by a built-in timer. Values are relayed in two- or three-digit form. Since the transmission sequence takes only about four sec, interruptions in the analog recording system are negligible. Although the digital signal will be "seen" by the rate readout devices, these are indicated as "pips" which will be identifiable by their regular occurrence. If desired, rate-recording and associated control devices can be switched out automatically during transmission of the digital signals.

The system, introduced by General Electric, is for use on any frequency-type telemetering channel.



• **ZERO-GRAVITY TOWER** is used for investigating the action of liquids and gases in controlled free fall for clues to their behavior in the weightlessness of space flight. The tower provides more than two sec of complete weightlessness.

Key to the weightlessness is a 180-lb capsule. An instrumented container falls in a vacuum inside the capsule. A motion picture camera and lights inside the container photograph the experiment. When the main capsule is dropped from the top of the tower, the container is released simultaneously and falls freely—unhampered by aerodynamic drag—inside the vacuum of the outer capsule.

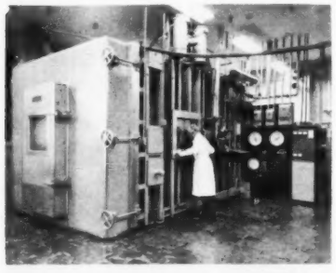
The 87-ft zero-gravity tower is part of Northrop Corp.'s Norair Div.'s Advanced Research Center in Hawthorne, Calif.

MECHANICAL HAND automatically plots weather map. Computer-plotter produces 30-by-30-inch weather maps in less than 3 minutes, compared to 20 minutes required by former hand-drawn method.

• **ELECTRONIC COMPUTER-PLOTTER** mechanically draws a complete weather map of the Northern Hemisphere. Known as the "Weather Plotter", the unit reads weather information supplied in numerical form on magnetic tape and presents the information to a digital-to-analog converter. The converter instructs the plotter to automatically draw contours or isobars.

The Weather Plotter, put into use by the U. S. Weather Bureau, was developed and is produced by Electronic Associates, Inc., Long Branch, N. J.

• **TEMPERATURE EXTREMES** ranging from 300F to —115F under simulated flight conditions up to 115,000 ft altitude can be reproduced in this 7-by-7-by-9-ft test chamber. Part of Boeing's mechanical equipment test laboratory in Wichita, the climate chamber is used for testing aircraft systems under heat extremes they will encounter in actual flight. During the tests, diving and climbing at the rate of 5000 fpm can be simulated.



Circle 56 on Reader-Service Card

WHY THIS IS A BETTER *LATCHING* RELAY

Better? Yes, in several ways. Bifurcated Contacts, for example, give improved reliability, especially in dry circuits. Contacts will not open during vibrations of 30Gs, 55 to 2500 cps. A special method of sealing cover to base eliminates flux contamination of the contacts. And there are more. Here is Potter & Brumfield's newest member of a distinguished family of micro-miniature relays: the FL Series.

Expressly designed for printed circuit applications, this DPDT, 3 amperes (@ 30V DC) latching relay lies parallel to the mounting surface. Its height, when mounted, is only .485", thus circuit boards may be stacked closer. Mounting can usually be accomplished without studs or brackets, simplifying installation.

The FL will remain firmly latched in either armature position without applied power, a significant advantage where power is limited and long relay "on" times are required. This relay may be operated by:

1. Pulsing each coil alternately (observing coil polarity), or
2. Connecting the coils in series and operating from a reversing (polarized) source.

Write for complete information or call your nearest P&B representative.

FL SERIES SPECIFICATIONS

Shock: 100 Gs for 11 milliseconds. No contact openings.

Vibration: .195", no contact openings. 10 to 55 cps. 30 Gs from 55 to 2500 cps.

Pull-In: 150 milliwatts maximum (standard) at 25° C. 80 milliwatts maximum (special) at 25° C.

Operate Time: 3 milliseconds maximum at nominal voltage at 25° C.

Transfer Time: 0.5 millisecond maximum at nominal voltage at 25° C.

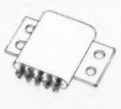
Temperature Range: −65° C to +125° C.

Terminals: Plug-in pins.

Dimensions: L. 1.100" Max.—W. .925" Max H. .485" Max. Hermetically sealed only.

SC 11 D

SCG 11 DC



SL 11 DB (Latching)

SLG 11 DA (Latching)

Other P&B micro-miniature relays include conventional and latching models in crystal cases with a wide range of terminals and mountings. All are made in a near-surgically clean production area under the exacting requirements of our Intensified Control and Reliability program.

P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR

YOUR BEST SINGLE SOURCE FOR ALL MICRO-MINIATURE RELAYS

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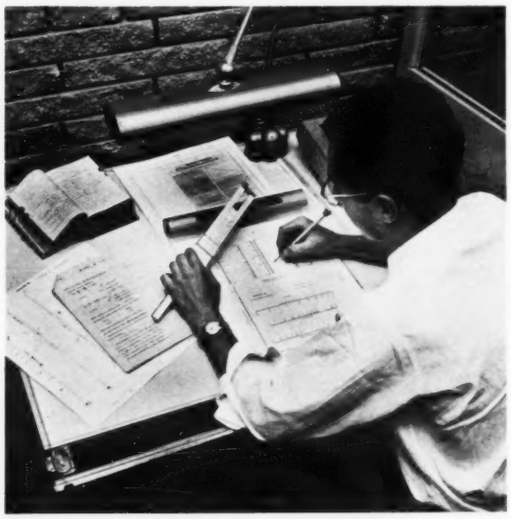
Effective Communication...



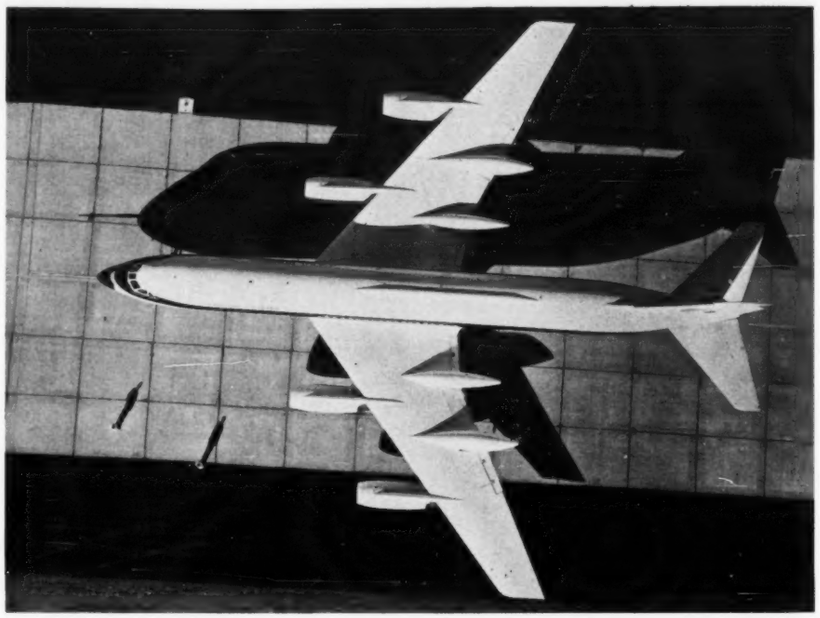
Illustrating

DESIGN DATA NEWS

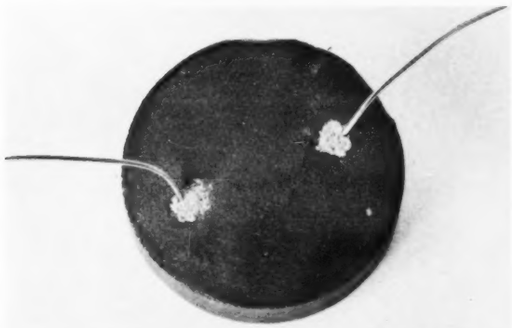
RELEASES...

• **FIRST CONVAIR 990,** a second-generation jet airliner able to cut transcontinental non-stop flight times by as much as 45 minutes, has been completed by Convair Div. of General Dynamics Corp. It has a maximum level cruising speed of 640 mph. The design incorporates more powerful engines and aerodynamic improvements.

CONVAIR 990 has supersonic wing including 4 speed-capsules to minimize sonic shock-wave and resultant drag. Wing is thinner and has more leading edge sweep (39 deg) than other transports. Speed-capsules, pointed at each end, are on upper surface of wing and extend back of wing trailing edge. Engine pod has increased diameter to allow air to be drawn around basic engine by aft fan. Result is approximately 40 percent greater efficiency.

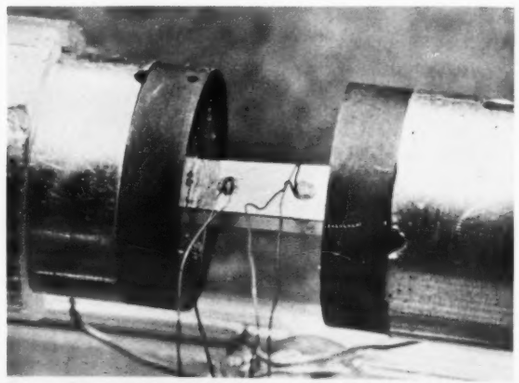


• **GALLIUM ALLOYS** suitable for the low-temperature bonding of wires to heat-sensitive electronic devices have been developed by the National Bureau of Standards. Like mercury, gallium will combine with many metals to form dental-type alloys which are soft at the time of mixing, and which harden after 2 to 24 hours. The alloys resist temperatures up to 900C after hardening. The Bureau also found that they could be used to "cold solder" certain ceramic and metallic surfaces.



GALLIUM-GOLD ALLOY was used to fasten wires to a small, electrically conductive ferrite specimen. This alloy resists temperatures to 500C after hardening.

PLATELET OF SILICON CARBIDE (0.6 by 0.25 by 0.008 cm) mounted between two electrical contacts. Specimen is backed with special glass, which provides mechanical support. Thermocouple leads have been attached to sample with gallium-copper alloy, resistant to 900C after hardening.



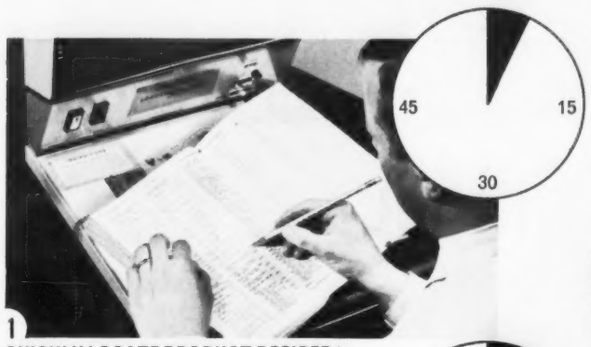
• **"ULTRASONIC CAN OPENERS"** to aid demolition squads in disarming unexploded bombs are being studied by engineers at Raytheon Co.'s Commercial Apparatus and Systems Div., Norwood, Mass. The study aims at developing a technique, beyond the audible range, for cutting into steel-encased bombs without generating excessive heat.

• **NORTHEAST AIRLINE'S CONVAIR 880** jet airliner set an unofficial "corner-to-corner" U. S. speed record by flying from San Diego to Boston in 4 hr and 17 minutes. The 880 flight achieved an average ground speed of 638 mph and a top ground speed of 692 mph over Indiana.

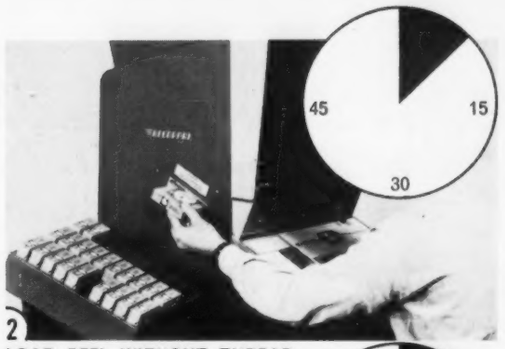
• **U. S. NAVY'S** new twin-turbine HSS-2 helicopter will be a key weapon in the nation's anti-submarine warfare defenses when it goes into service some time in 1961. The aircraft has undergone the most extensive flight and laboratory test program ever undertaken for a new helicopter. HSS-2's have logged an aggregate of more than 1100 flight hours in test and demonstration flights at East Coast Naval Air stations and at the Sikorsky plant in Stratford, Conn. The whirlybird can light on and take off from water in an emergency. It is in the weight class of a medium transport helicopter and has the capability to continue flight to normal landing areas with one engine in operation.

• **"ELSSY"** ("electronic sortation system") soon will be giving Uncle Sam's mailmen a big assist toward the swift completion of their rounds. The electronic sorting system, designed and manufactured by Stewart-Warner Corp. of Chicago, can handle in a minute 25 boxes, cartons, crates, pails or any other type of parcel. Rated capacity of the system is 55,000 parcels a day.

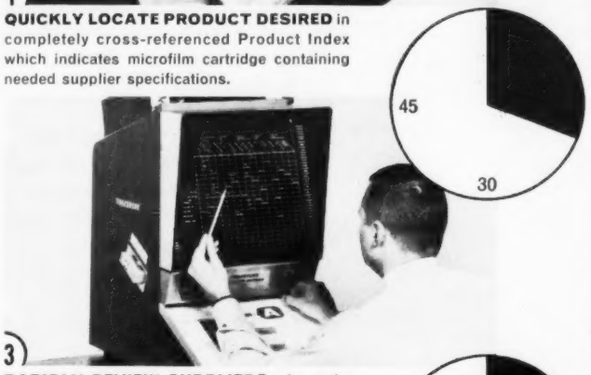
U. S. AIR FORCE units at Portland Air Defense Sector have "adopted" part of the U. S. Navy into the PADS organization—a segment of the multi-service, international North American Air Defense Command. On a 'round-the-clock, seven-days-a-week basis, Navy radar vessels collect and feed electronic data into Portland Sector's three-story direction center near Corvallis, Ore. "They're our sea-going radar stations," says Col. Leon W. Gray, sector commander. "We consider them part of our organization, at least in the operational sense, and we think of them as *our* Navy."



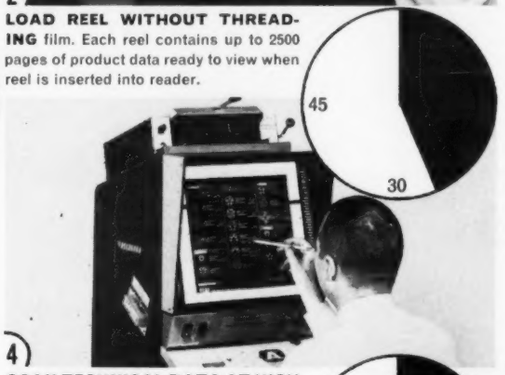
1 **QUICKLY LOCATE PRODUCT DESIRED** in completely cross-referenced Product Index which indicates microfilm cartridge containing needed supplier specifications.



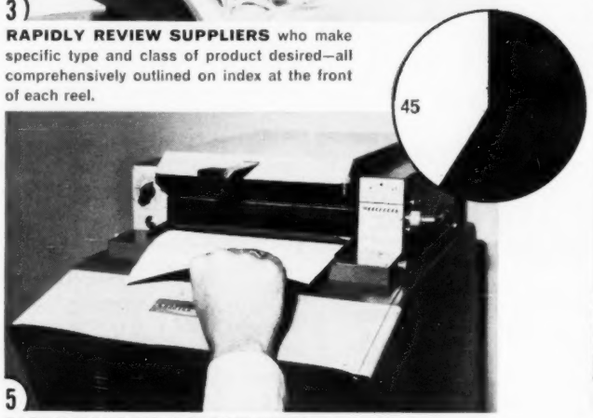
2 **LOAD REEL WITHOUT THREADING** film. Each reel contains up to 2500 pages of product data ready to view when reel is inserted into reader.



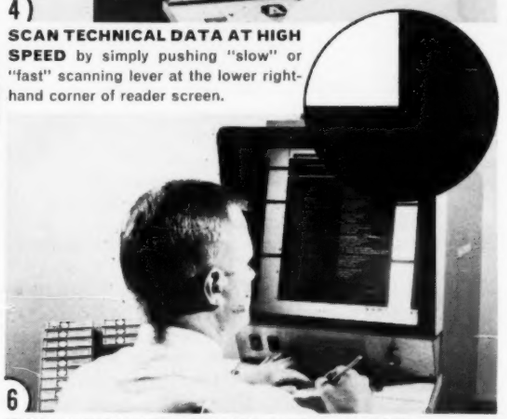
3 **RAPIDLY REVIEW SUPPLIERS** who make specific type and class of product desired—all comprehensively outlined on index at the front of each reel.



4 **SCAN TECHNICAL DATA AT HIGH SPEED** by simply pushing "slow" or "fast" scanning lever at the lower right-hand corner of reader screen.



5 **EASILY MAKE INEXPENSIVE COPY** with high-fidelity simple-to-operate printing attachment. Makes full size black and white positive print of any page in the reel.



6 **IMMEDIATELY FIND NEAREST SALES-OFFICE** at the end of each reel. All are arranged in standard format including state, city, address and phone.

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...is what VSMF, the Microfilm Catalog File, means because you can use it to find the product data you need in less than 45 seconds. It is the new industrial communications service which combines a comprehensive indexing technique with microfilm equipment. VSMF provides a single up-to-date source of product information requiring minimum space at an annual cost of less than the salary of one file clerk.

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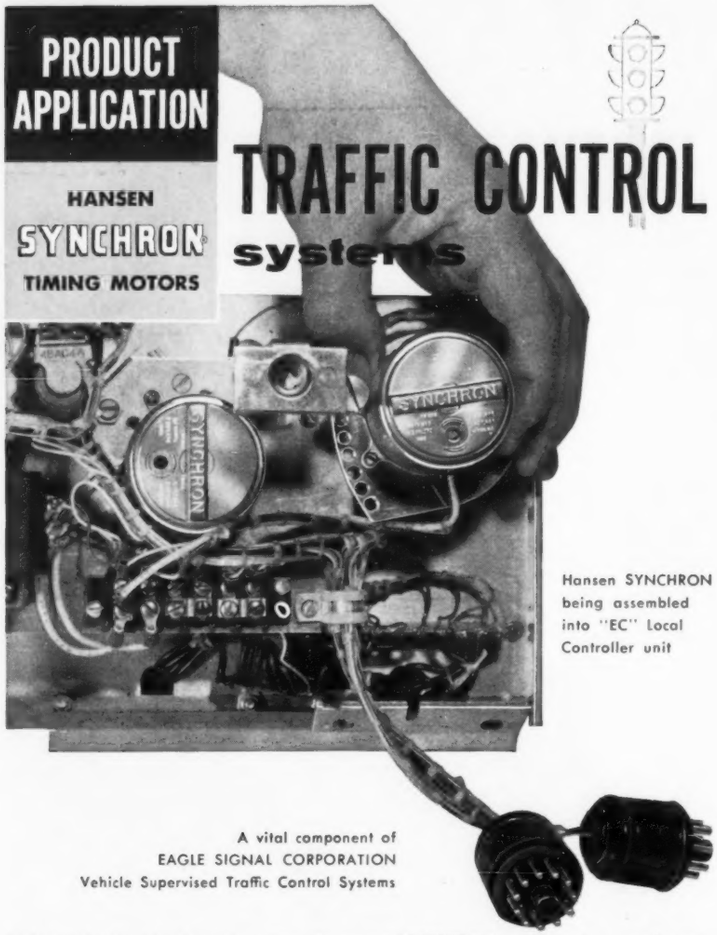
PRODUCT APPLICATION

HANSEN SYNCHRON TIMING MOTORS

TRAFFIC CONTROL systems



Hansen SYNCHRON being assembled into "EC" Local Controller unit

A vital component of EAGLE SIGNAL CORPORATION Vehicle Supervised Traffic Control Systems

EAGLE SIGNAL CORPORATION uses Hansen SYNCHRON motors for synchronous power to govern signal timing operations in "EC" Traffic Control Systems. Hansen SYNCHRON motors regulate amber and pedestrian clearing intervals — and all other intervals which remain *constant* regardless of cycle length . . . and also govern the 4 independent traffic splits (time division for vehicular traffic) — as well as any interval which is *variable* according to cycle length. The Hansen SYNCHRON, regulating constant intervals, operates on 60-cycle power supply . . . the one governing variable intervals responds to variable frequency from the master control unit.

HANSEN SYNCHRON TIMING MOTORS were chosen by Eagle Signal after careful testing of several makes of synchronous motors. Due to the size of some timing devices and control units, a small motor with good performance characteristics was needed to fit the space limitations. After extensive tests, Hansen SYNCHRON motors were specified for: (1) high-quality performance under test; (2) lower cost; (3) long-life operation as an integral part of traffic control units. Since adoption, Eagle Signal has never experienced an assembly slowdown or stoppage due to failure on service or delivery of Hansen SYNCHRON Timing Motors.

SEND TODAY for informative folder containing specifications and technical data on all Hansen SYNCHRON motors and clock movements.

HANSEN MANUFACTURING COMPANY, INC. PRINCETON, INDIANA

HANSEN REPRESENTATIVES:

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ELECTRIC MOTOR ENGINEERING, INC.
Los Angeles, Calif. — (OLive 1-3220)
Oakland, California

WINSLOW ELECTRIC CO.
New York, N.Y. — Essex, Conn. (SOuth 7-8229)
Philadelphia, Penn. Cleveland, Ohio

Sweet's Product Design File

Circle 58 on Reader-Service Card for more information

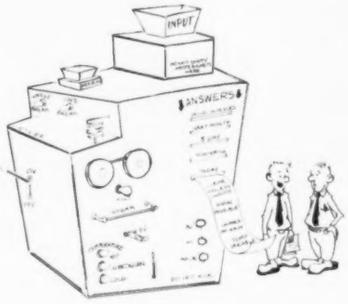
PLANS AND CROSS-SECTIONS

Weather or Not to Predict

That Is the Question

Have you heard the one about . . . . . the recently hired employee at the Weather Bureau. When he inquired about his new position, he was informed he was to be 2nd assistant guesser in charge of the 5-day forecasts.

The days the "weather man" must take the brunt of such jokes may be limited in number. AMOS IV, a specialized digital computer, has been developed as a research tool to explore the possibilities of an automatic weather station. Built by the National Bureau of Standards in cooperation with the U. S. Weather Bureau, the AMOS IV receives data from weather-sensing instruments, then processes and arranges the data for teletype transmission to a central forecasting station and to airport weather stations. It can continuously monitor new input data—such as temperature, wind speed and direction, atmosphere pressure, cloud height—while simultaneously processing data already entered and transmitting messages on command.



It seems to lack conviction . . . .

Earlier versions of AMOS required several complex units to handle input quantities. In AMOS IV there has been a considerable reduction in components and maintenance.

Another 'Better' Mouse Trap

Inventors are still trying to come up with a better mouse trap, and the newest innovation, patented recently, uses the fly paper principle.

Samuel T. Hughes of Cullman, Ala., devised a rodent-catching device that has the appearance of a flat-roofed bird house. A rectangular hood with round entry holes in either end fits over a pad of sticky papers. The bait is placed in a small bucket mounted inside one corner of the hood. When a mouse ventures into the building, it is trapped on the adhesive floor.

What's the boss trying to do—run this place?

A Suggestion - -

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NEW PRODUCTS

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MECHANICAL

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ELECTRICAL

Components, electronic .....
Diodes, medium power silicon .....
Potentiometers, precision .....
Switches, precision snap-action .....

MATERIALS

Alloys, titanium .....
Insulation, electrical .....

EQUIPMENT

Headphones, binaural and monaural ....

DESIGN AIDS

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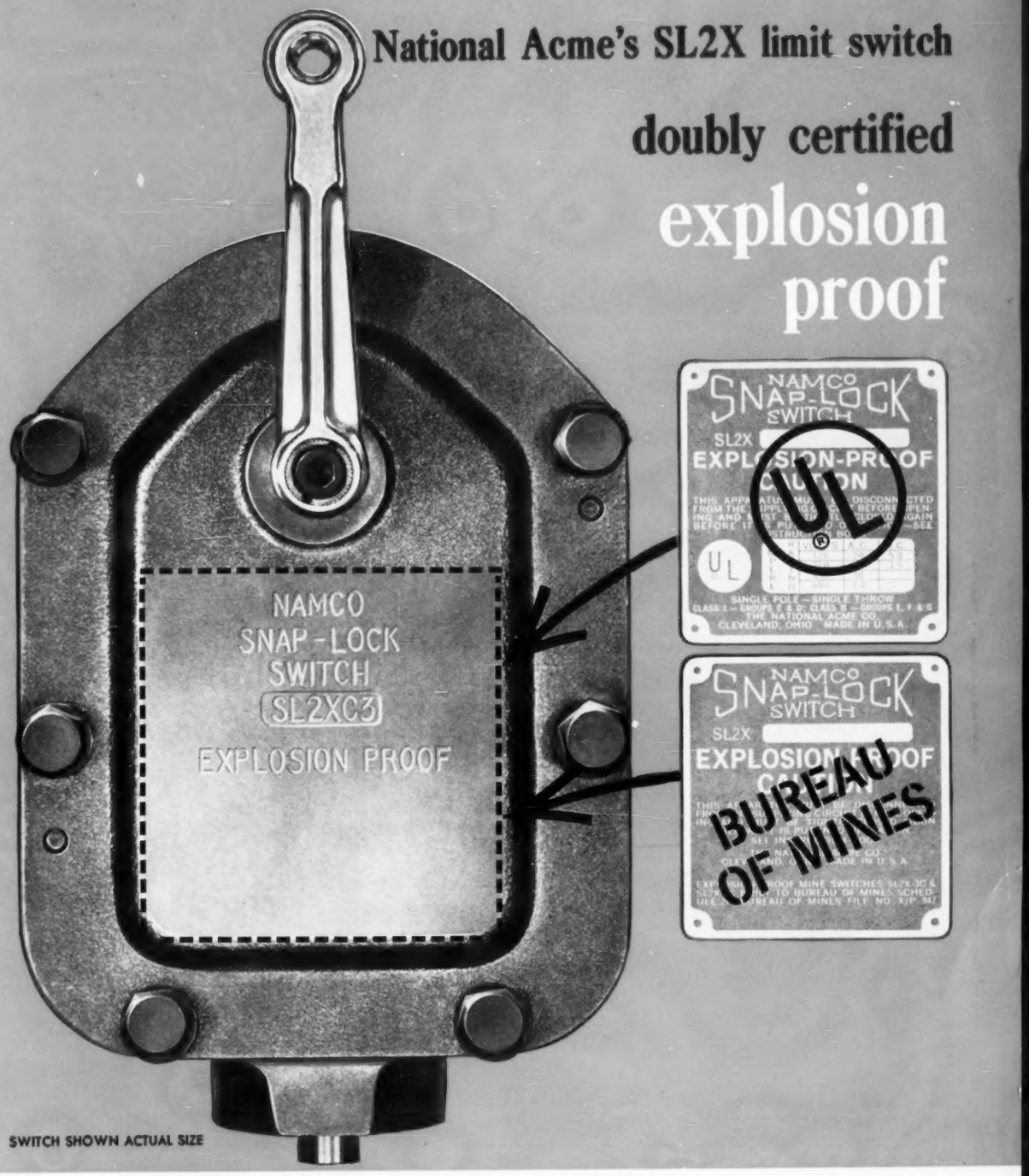

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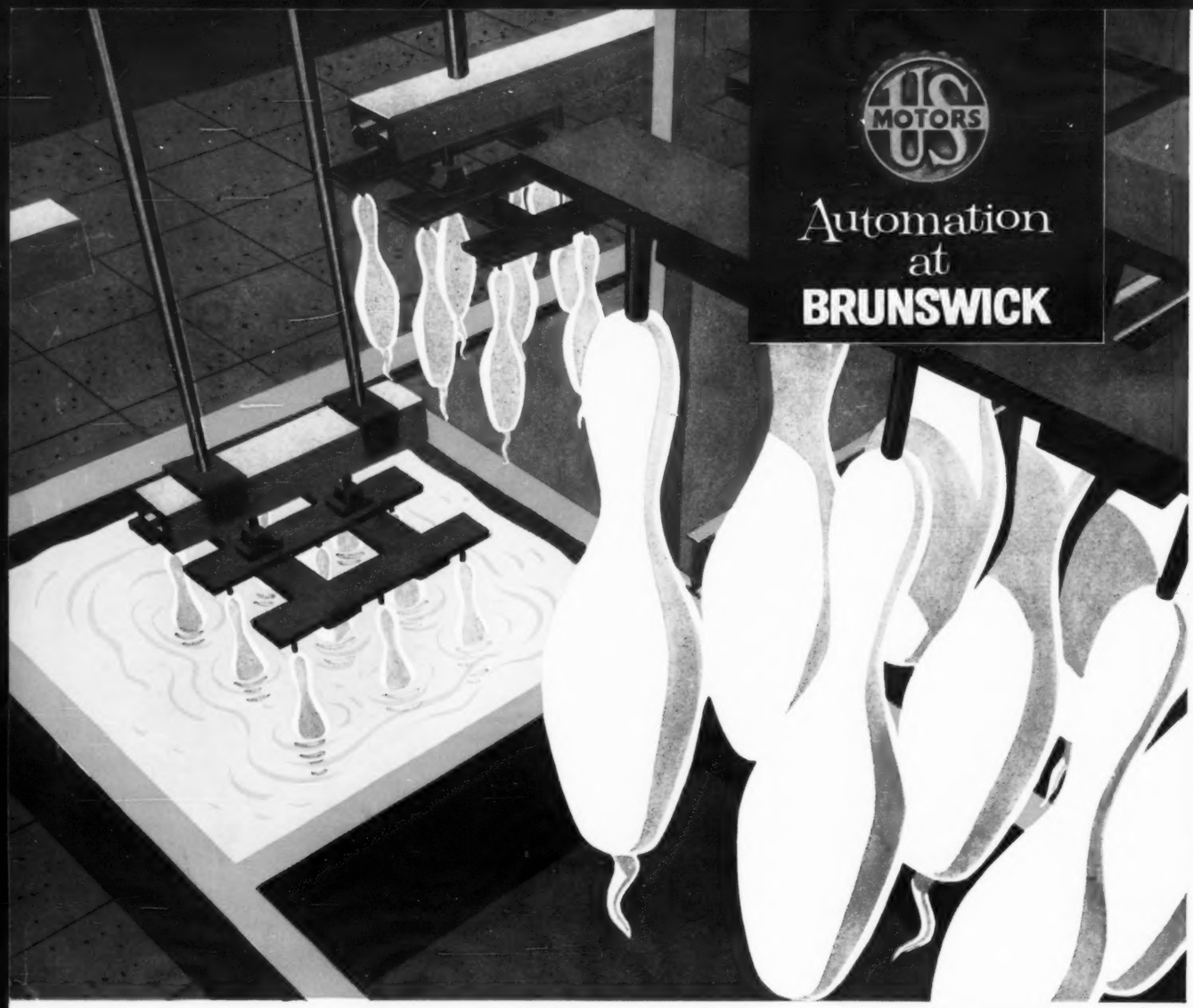

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